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FINAL SUBMITTAL

ENERGY SURVEY OF
ARMY INDUSTRIAL FACILITIES
ENERGY ENGINEERING ANALYSIS PROGRAM
LETTERKENNY ARMY DEPOT
CHAMBERSBURG, PENNSYLVANIA

VOLUME I

NARRATIVE REPORT

CONTRACT NO. DACA65-91-C-0071

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
NORFOLK, VIRGINIA

PREPARED BY:

REYNOLDS, SMITH AND HILLS, INC.
ENERGY AND ENVIRONMENTAL SERVICES DEPARTMENT
P.O. BOX 4850
JACKSONVILLE, FLORIDA 32201
904/279-2277

PROJECT NO. 2900379001

JANUARY 1992

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EXECUTIVE SUMMARY

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1.0 INTRODUCTION

1.1 Authorization

The Energy Engineering Analysis Program (EEAP), Energy Survey of Army Industrial Facility (ESAIF), Letterkenny Army Depot, Pennsylvania was authorized by the Department of the Army, Norfolk District Corps of Engineers, under Contract Number DACA65-91-C-0071. The objective of this study is to identify, evaluate and develop energy-saving projects which meet the criteria of the Department of the Army's many energy funding programs.

1.2 Report Organization

The report consists of an Executive Summary and four volumes. Volume I, the Narrative Report, contains the results of all of the site surveys, analysis and project development. All backup data and calculations are found in Volume II. The site survey notes are in Volume III, and project documentation forms necessary for receiving funding are in Volume IV.

2.0 INSTALLATION DESCRIPTION

Letterkenny Army Depot is located north of I-85 in South Central Pennsylvania, about five miles north of Chambersburg and eight miles southwest of Shippensburg. The facility was built in 1942 for ordnance storage and tank maintenance during World War II. The facilities at LEAD have evolved and improved but the basic mission is still supply, ammunition and maintenance. The ten directorates at LEAD which combine to perform this mission are:

- Maintenance
- Ammunition
- Supply
- Quality Assurance
- Resource Management
- Information Management
- Contracting
- Engineering and Logistics
- Personnel and Community Activities
- Law Enforcement and Security

The LEAD facilities cover over 20,000 acres of land and include about 980 buildings. The employment level as of September 1990 was 4,656. Figure 2-1 is a site plan of LEAD and shows the location of the various production facilities. The industrial areas (and Directorate) covered under the scope of work for this study include:

- Vehicle Maintenance (Maintenance)
- Electronic Systems Maintenance (Maintenance)
- Engine/Transmission Maintenance (Maintenance)
- Vehicle Care and Painting (Supply)
- Major Item Storage (Supply)
- Secondary Item Storage and Distribution (Supply)
- General Plant
  - Process Heating Systems
  - Space Heating Systems
  - Water Treatment Facilities

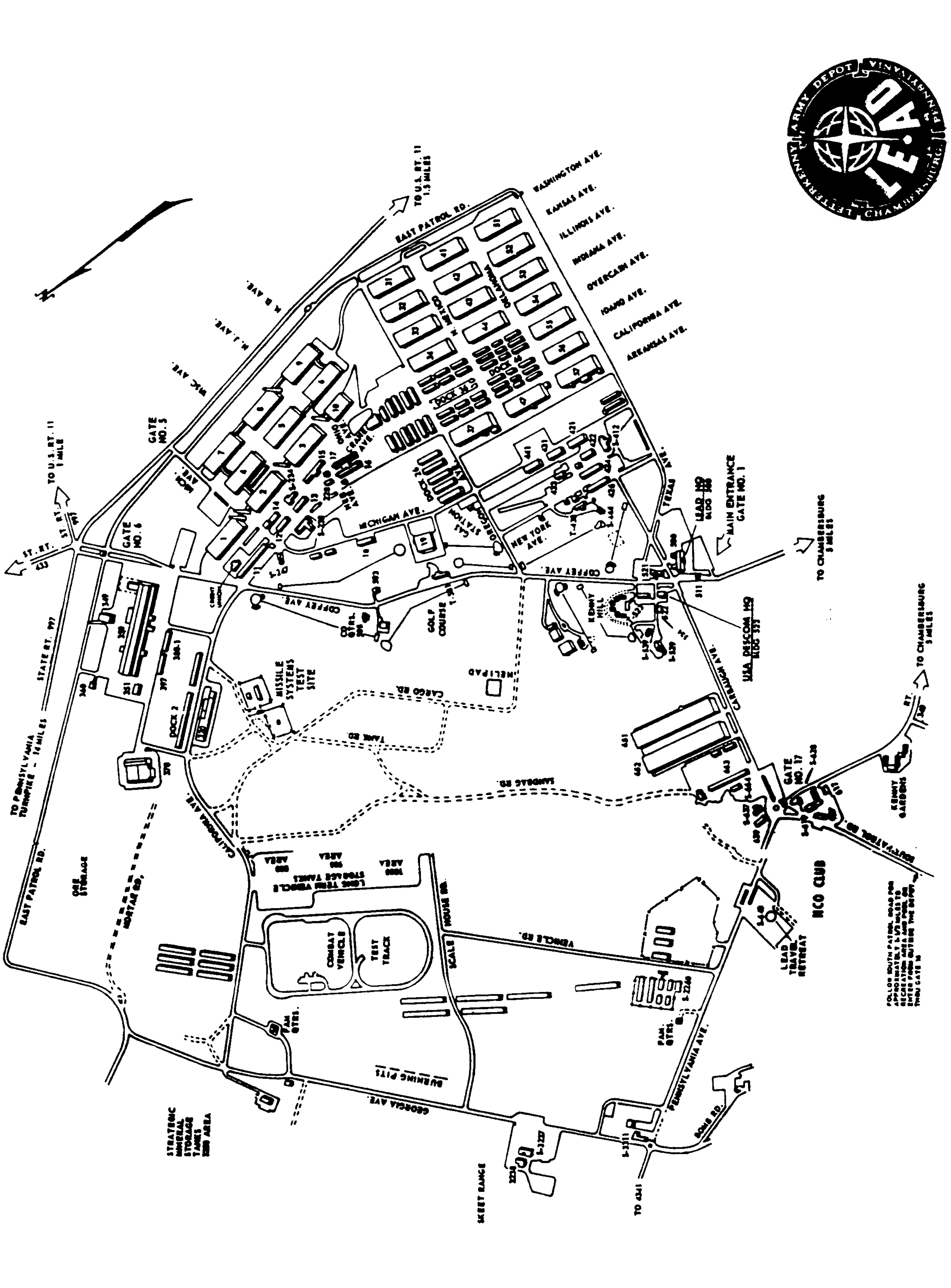

TO U.S. RT. 11 1.5 MILES
EAST PATROL RD.
WASHINGTON AVE.
KANSAS AVE.
ILLINOIS AVE.
INDIANA AVE.
OVERCASH AVE.
IDAHO AVE.
CALIFORNIA AVE.
ARKANSAS AVE.
GATE NO. 5
GATE NO. 6
TO U.S. RT. 11 1 MILE
MICHIGAN AVE.
NEW YORK AVE.
COFFEY AVE.
TEXAS AVE.
MAIN ENTRANCE GATE NO. 1
TO CHAMBERSBURG 5 MILES
GOLF COURSE
HELIPAD
MISSILE SYSTEMS TEST SITE
CARGO RD.
DOCK 2
STATE RT. 997
TO PENNSYLVANIA TURNPIKE - 14 MILES
EAST PATROL RD.
ORE STORAGE
MORTAR RD.
CALIFORNIA AVE.
LONG TERM VEHICLE STORAGE TANKS
COMBAT VEHICLE TEST TRACK
SCALE HOUSE RD.
VEHICLE RD.
BURNING PITS
GEORGIA AVE.
PENNSYLVANIA AVE.
STRATEGIC MINERAL STORAGE TANKS 2200 AREA
SKEET RANGE
TO 4341
NCO CLUB
LEAD TRAVEL RETREAT
KENNY GARDENS
GATE NO. 17
CARBAUGH AVE.
TO CHAMBERSBURG 5 MILES

FIGURE 2-1

3.0 ENERGY CONSUMPTION

Total facility and production energy consumption at LEAD decreased by approximately 7.6 percent from FY 88 through FY 91 (Figure 3-1). The cause for the decrease was because of decreases in use of primary boiler fuels (FSR and FSD), which was related to weather. Electricity consumption, on the other hand, has remained relatively constant, showing a 2.5-percent increase over the same time period.

Monthly consumption of boiler fuels and electricity for FY 88-91 is shown in Figure 3-2. The strong dependence of boiler fuels on weather is readily apparent, although some steam is generated during the summer months for uses other than heating. Electricity use is fairly constant throughout the year, showing that almost all electricity consumption is strictly work related.

Percentages of fuel use for FY 90 are shown in Figure 3-3. The two primary boiler fuels accounted for approximately 63 percent of energy use in that year. However, energy costs by fuel type show a different picture (Figure 3-3a). The higher price paid for electricity causes it to represent the largest part of the annual LEAD utility bill at 61 percent. Also, due to the recent trend in decreasing energy prices, total annual energy costs at LEAD decreased by 18.3 percent from FY 88 through FY 91 (Figure 3-4).

Letterkenny Army Depot
Historical Energy Use

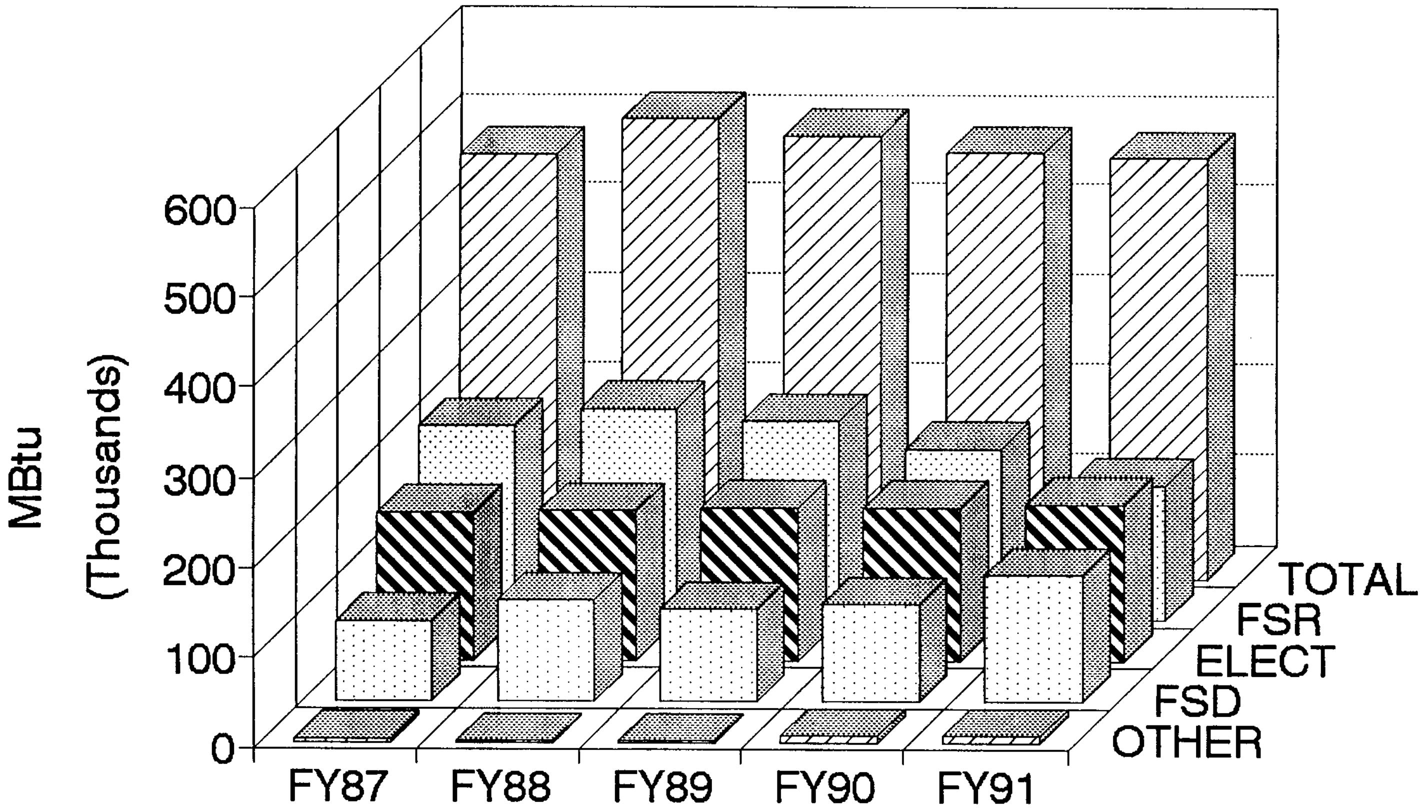


Figure 3-1

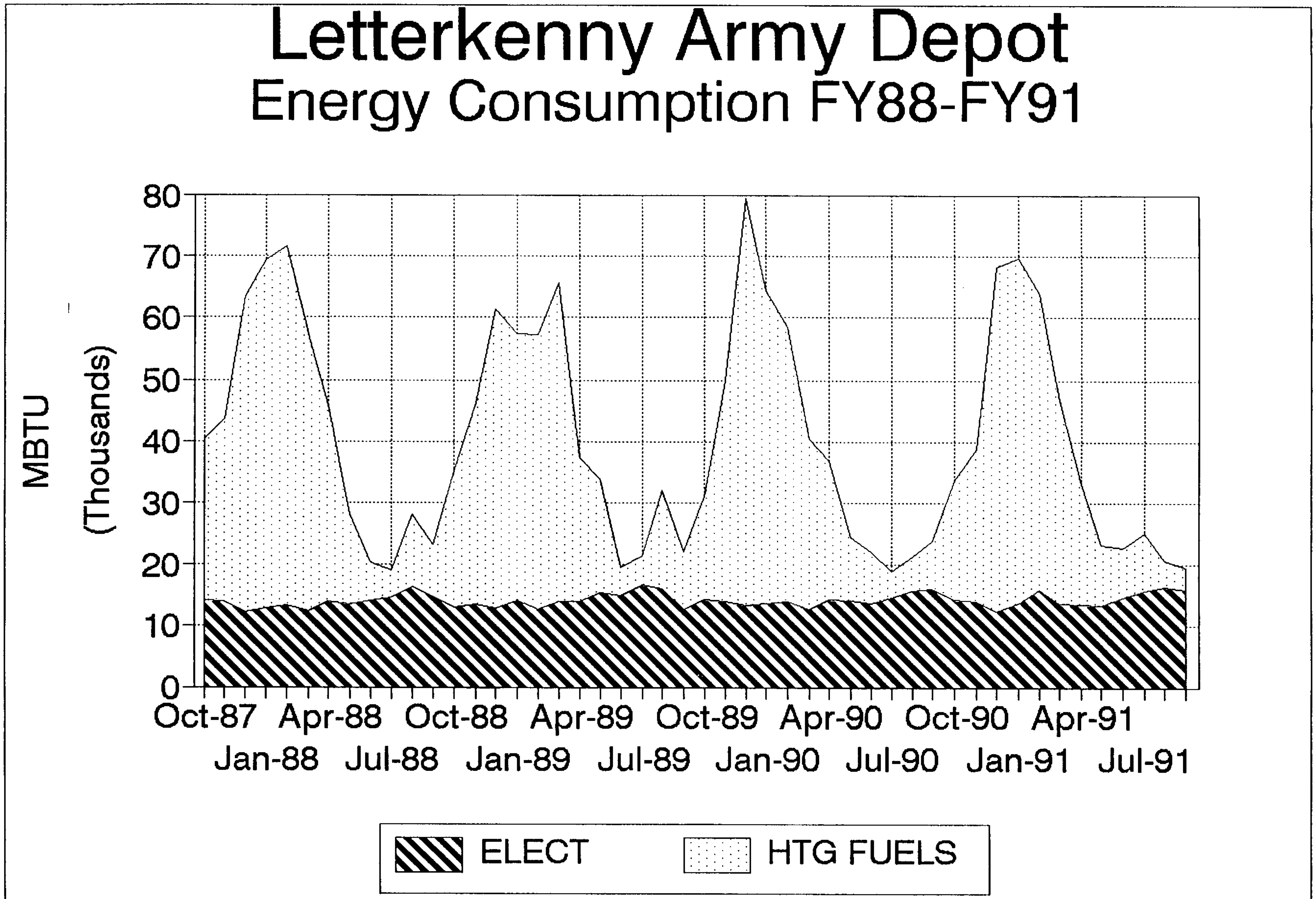
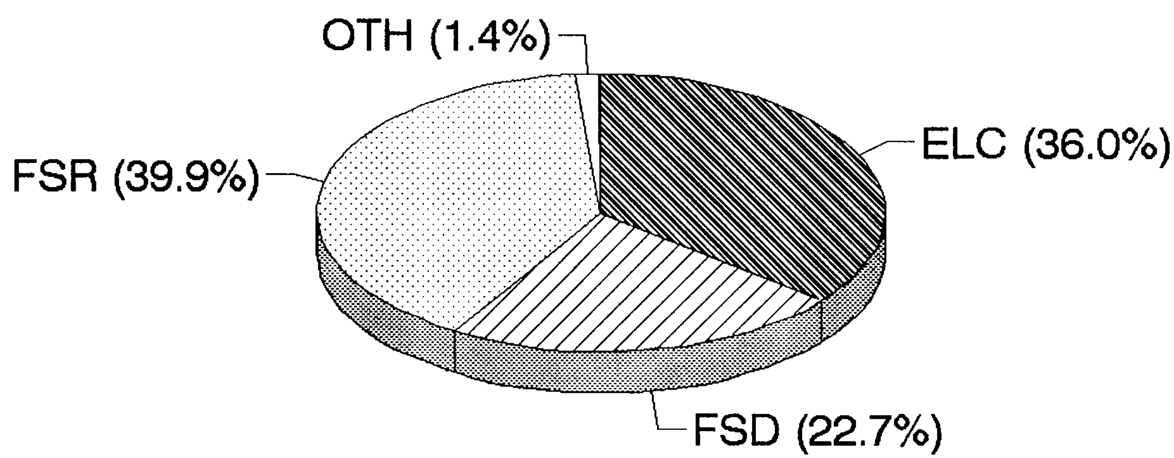

Letterkenny Army Depot
Energy Consumption FY88-FY91
MBTU
(Thousands)
80
70
60
50
40
30
20
10
0
Oct-87
Jan-88
Apr-88
Jul-88
Oct-88
Jan-89
Apr-89
Jul-89
Oct-89
Jan-90
Apr-90
Jul-90
Oct-90
Jan-91
Apr-91
Jul-91
ELECT
HTG FUELS

Figure 3-2

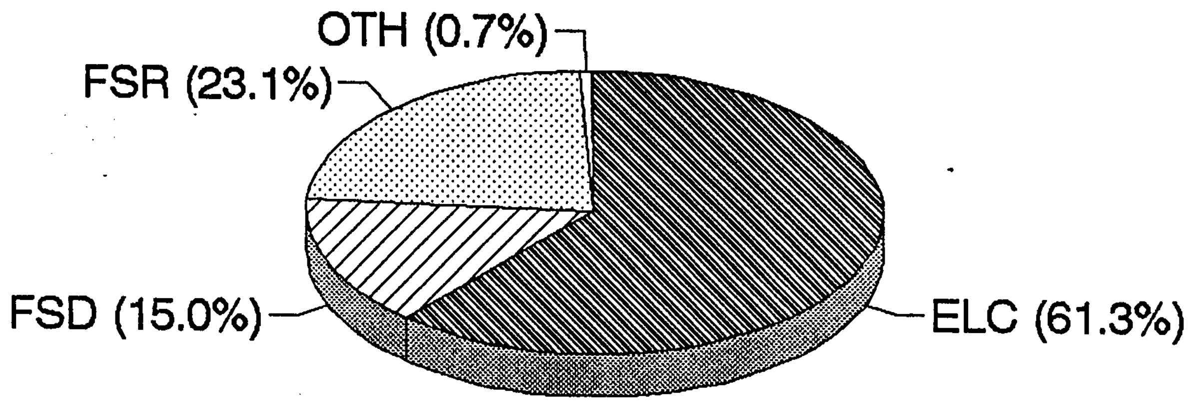
Letterkenny Army Depot
FY90 Facility Energy Use



Total Use = 472,493 MBtu

Figure 3-3

Letterkenny Army Depot
FY90 Facility Energy Cost



Total Cost = $2,895,000

Figure 3-3a

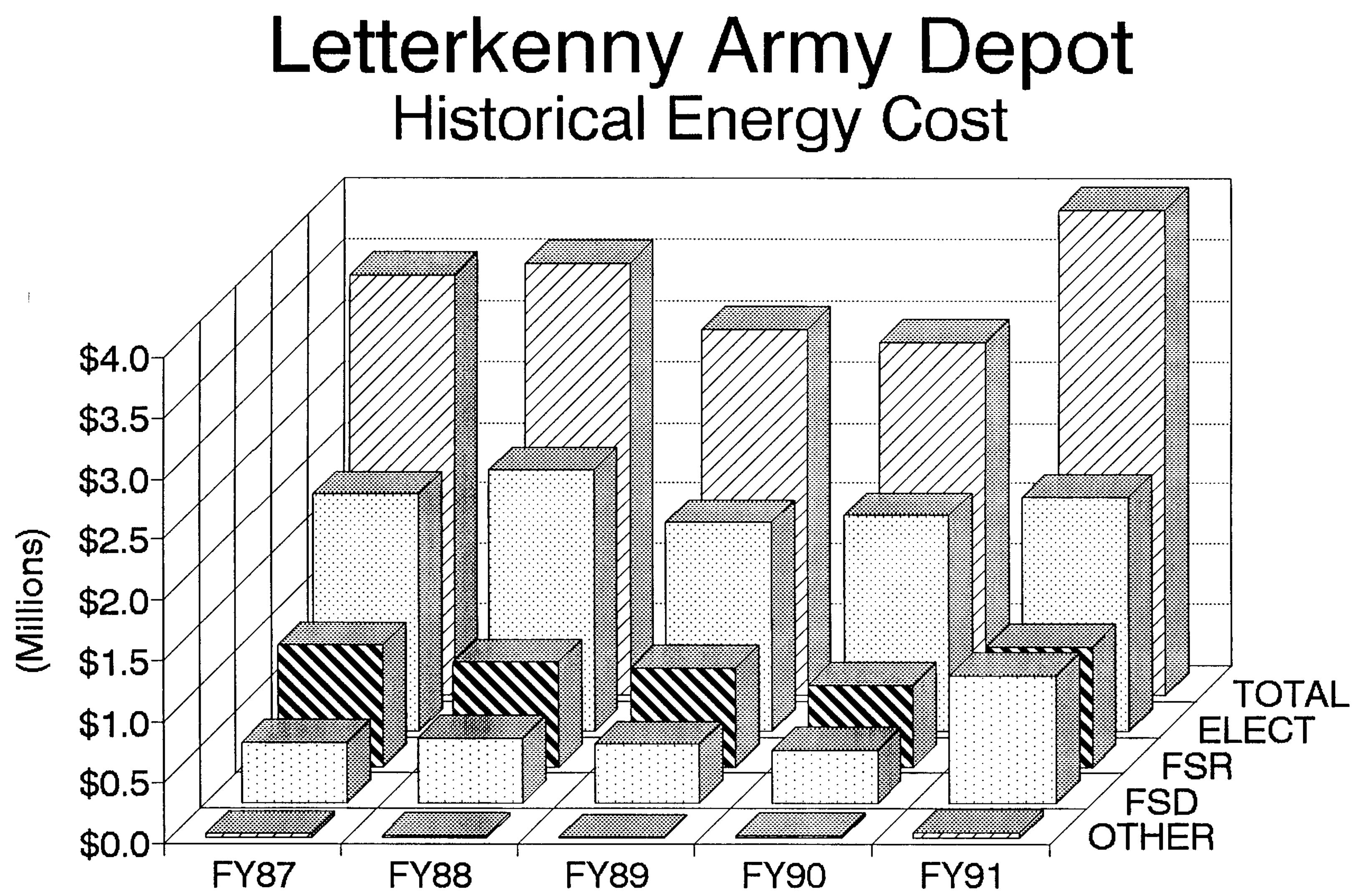

Letterkenny Army Depot
Historical Energy Cost
(Millions)
$4.0
$3.5
$3.0
$2.5
$2.0
$1.5
$1.0
$0.5
$0.0
FY87
FY88
FY89
FY90
FY91
TOTAL
ELECT
FSR
FSD
OTHER

Figure 3-4

4.0 ENERGY CONSERVATION ANALYSIS

4.1 Energy Conservation Opportunity (ECO) Evaluations

Each of the ECOs listed in the Scope of Work plus others were reviewed for their applicability and potential for significant energy savings and cost effectiveness for buildings representative of high energy consumption process areas at LEAD. The buildings actually surveyed vary slightly from the list in the scope of work, but the intent of the survey was accomplished--to survey and investigate energy savings in the major energy users in all active production areas. The results of this assessment are contained in tables in Volume II, Appendix B.

For each of the ECOs that were chosen to be evaluated, energy savings were calculated, cost estimates made and Life Cycle Cost Analyses performed. A summary of the results are contained in Tables 4-1 and 4-2. The evaluated ECOs are described and listed in Table 4-1. An alphabetical listing of evaluated ECOs along with a summary of the energy and cost savings analysis is shown in Table 4-2. Table 4-3 contains a listing prioritized by SIR. Table 4-4 contains a list prioritized by simple payback. Backup data and calculations are contained in Appendix B.

The ECO numbers are of the form ECO # or ECO X-UP where # represents a number and X represents a letter. The ECOs with letters designate an ECO that is being updated from a previous EEAP Study. The sequentially numbered ECOs are new ones.

4.2 Operations and Maintenance Energy Savings

4.2.1 Energy Savings Ideas. As a result of the site visit to LEAD, several operations and maintenance (O&M) energy savings ideas were identified. Energy and economic analyses were performed for these recommendations. Recommendations are listed below.

- o Upon Failure, Replace Fluorescent Lamps with Energy-Efficient Types.

Table 4-1. ECOs Evaluated - Titles

No	ECO #	Description
1	1	Compressed air valve replacement in Building 350
2	2	Change "Steam" clean heating method in Bldgs. 349 & 351
3	3	Dip tank covers in Buildings 1, 37, 350 & 370
4	4	Heat recovery from paint booth exhaust air
5	5	EMCS in Building 370
6	6	Heat recovery from condensate in Building 349
7	7	No. 6 fuel oil recirculation control in Building 349
8	8	Reflectors for fluorescent fixtures in Buildings 5 & 370
9	9	Paint booth fan controls
10	10	Paint booth air flow control in Buildings 320 & 350
11	11	Blast booth fan cut off in Buildings 37 & 350
12	12	Boiler conversion to #5 fuel oil in Bldgs. 2, 8, 37 & 320
13	13	Energy efficient fluorescent lamps in Building 370
14	14	Energy efficient frequency converters in Building 370
15	15	Modular offices in Buildings 6-South, 8 & 9
16	16	Boiler conversion to natural gas in ten buildings
17	D-UP	Heat recovery from paint booths and engine test cells
18	E-UP	Vapor barrier for dehumidified warehouses
19	G-UP	Dip tank exhaust heat recovery in Building 350-North
20	H-UP	Baghouse insulation & exhaust air return in Bldgs. 37 & 35
21	I-UP	Large paint booth exhaust heat recovery in Building 350
22	J-UP	Medium paint booth exhaust heat recovery in Building 350
23	N-UP	Window & wall insulation in Bldgs. 422, 424, 426, 433 & 43
24	R-UP	High pressure sodium lighting in Bldgs. 31 - 34 & 41 - 44
25	G-E-UP	Paint booth exhaust heat recovery in Building 1
26	G-F-UP	Paint booth exhaust heat recovery in Building 14
27	G-G-UP	Paint booth exhaust heat recovery in Building 37
28	G-I-UP	Dip tank exhaust heat recovery in Building 350-South
29	G-J-UP	Main steam system expansion to Building 320
30	G-N-UP	Warehouse door seals in Buildings 2 and 4
31	G-P-UP	Strip curtains for warehouse doors in Building 2 and 4
32	G-U-UP	Storm windows in Building 3
33	G-V-UP	Loading dock door seals for Building 2

Table 4-2. ECO Evaluations - Results

No.	ECO #	Construction Cost Plus SIOH	Savings (Increase), MBtu/Year Elec	Dist	Resid	N Gas	Net Cost Savings	SIR	Simple Payback (Years)
1	1	$7,671	366	-	-	-	$4,004	7.5	2.0
2	2	$15,985	-	-	-	-	-	-	-
3	3	$198,942	2,496	-	26,034	-	$137,400	10.0	1.5
4	4	-	-	-	-	-	-	-	-
5	5	$172,629	2,640	-	6,536	-	$57,700	4.3	3.2
6	6	$2,557	-	-	938	-	$4,100	38.6	0.7
7	7	-	-	-	-	-	-	-	-
8	8	$33,778	613	-	-	-	$6,711	2.8	5.3
9	9	$4,858	124	-	4,895	-	$22,900	71.0	0.2
10	10	$224,367	1,503	5,674	4,397	-	$64,100	3.8	3.7
11	11	$6,888	1,610	-	-	-	$17,613	26.0	0.4
12	12	$94,587	-	32,504	(32,504)	-	$26,653	-2.7	3.8
13	13	$19,400	153	-	-	-	$1,677	1.2	12.2
14	14	$147,457	567	-	-	-	$6,203	0.6	25.1
15	15	$24,637	(20)	2,775	-	-	$13,600	11.2	1.9
16	16	$2,415,158	-	36,513	226,569	(263,082)	$160,200	3.1	15.9
17	D-UP	$310,602	(750)	425	2,249	-	$9,819	1.0	33.4
18	E-UP	$799,693	5,937	-	-	-	$49,791	0.9	17.0
19	G-UP	$225,142	(107)	-	6,453	-	$27,300	2.9	8.7
20	H-UP	$132,659	-	-	2,988	-	$13,200	2.4	10.6
21	I-UP	$382,805	(1,111)	-	3,703	-	$12,322	1.1	32.8
22	J-UP	$382,804	(1,010)	-	3,644	-	$13,037	1.1	31.0
23	N-UP	$122,307	-	-	2,749	-	$13,700	2.3	9.4
24	R-UP	$287,199	465	-	-	-	$5,087	0.3	59.7
25	G-E-UP	$115,821	(141)	-	510	-	$1,829	0.5	67.0
26	G-F-UP	$93,779	(90)	-	325	-	$1,164	0.4	85.2
27	G-G-UP	$115,821	(109)	-	393	-	$1,405	0.4	87.1
28	G-I-UP	$40,123	(78)	-	338	-	$1,381	1.0	30.7
29	G-J-UP	$1,065,732	-	8,780	8,780	-	$7,200	0.0	147.4
30	G-N-UP	$51,320	-	900	1,982	-	$6,300	4.0	8.6
31	G-P-UP	$31,981	-	598	508	-	$611	2.2	55.3
32	G-U-UP	$29,144	-	-	255	-	$1,176	1.0	26.2
33	G-V-UP	$27,282	-	-	345	-	$1,500	1.3	19.0

Table 4-3. ECO Evaluations - Results Prioritized by SIR

No.	ECO #	Construction Cost Plus SIOH	Savings (Increase), MBtu/Year Elec	Dist	Resid	N Gas	Net Cost Savings	SIR	Simple Payback (Years)
1	9	$4,858	124	-	4,895	-	$22,900	71.0	0.2
2	6	$2,557	-	-	938	-	$4,100	38.6	0.7
3	11	$6,888	1,610	-	-	-	$17,613	26.0	0.4
4	15	$24,637	(20)	2,775	-	-	$13,600	11.2	1.9
5	3	$198,942	2,496	-	26,034	-	$137,400	10.0	1.5
6	1	$7,671	366	-	-	-	$4,004	7.5	2.0
7	5	$172,629	2,640	-	6,536	-	$57,700	4.3	3.2
8	G-N-UP	$51,320	-	900	1,982	-	$6,300	4.0	8.6
9	10	$224,367	1,503	5,674	4,397	-	$64,100	3.8	3.7
10	16	$2,415,158	-	36,513	226,569	(263,082)	$160,200	3.1	15.9
11	G-UP	$225,142	(107)	-	6,453	-	$27,300	2.9	8.7
12	8	$33,778	613	-	-	-	$6,711	2.8	5.3
13	H-UP	$132,659	-	-	2,988	-	$13,200	2.4	10.6
14	N-UP	$122,307	-	-	2,749	-	$13,700	2.3	9.4
15	G-P-UP	$31,981	-	598	508	-	$611	2.2	55.3
16	G-V-UP	$27,282	-	-	345	-	$1,500	1.3	19.0
17	13	$19,400	153	-	-	-	$1,677	1.2	12.2
18	I-UP	$382,805	(1,111)	-	3,703	-	$12,322	1.1	32.8
19	J-UP	$382,804	(1,010)	-	3,644	-	$13,037	1.1	31.0
20	D-UP	$310,602	(750)	425	2,249	-	$9,819	1.0	33.4
21	G-I-UP	$40,123	(78)	-	338	-	$1,381	1.0	30.7
22	G-U-UP	$29,144	-	-	255	-	$1,176	1.0	26.2
23	E-UP	$799,693	5,937	-	-	-	$49,791	0.9	17.0
24	14	$147,457	567	-	-	-	$6,203	0.6	25.1
25	G-E-UP	$115,821	(141)	-	510	-	$1,829	0.5	67.0
26	G-F-UP	$93,779	(90)	-	325	-	$1,164	0.4	85.2
27	G-G-UP	$115,821	(109)	-	393	-	$1,405	0.4	87.1
28	R-UP	$287,199	465	-	-	-	$5,087	0.3	59.7
29	G-J-UP	$1,065,732	-	8,780	8,780	-	$7,200	0.0	147.4
30	12	$94,587	-	32,504	(32,504)	-	$26,653	-2.7	3.8
31	2	$15,985	-	-	-	-	-	-	-
32	7	-	-	-	-	-	-	-	-
33	4	-	-	-	-	-	-	-	-

Table 4-4. ECO Evaluations - Results Prioritized by Simple Payback

No.	ECO #	Construction Cost Plus SIOH	Savings (Increase), MBtu/Year Elec	Dist	Resid	N Gas	Net Cost Savings	SIR	Simple Payback (Years)
1	9	$4,858	124	-	4,895	-	$22,900	71.0	0.2
2	11	$6,888	1,610	-	-	-	$17,613	26.0	0.4
3	6	$2,557	-	-	938	-	$4,100	38.6	0.7
4	3	$198,942	2,496	-	26,034	-	$137,400	10.0	1.5
5	15	$24,637	(20)	2,775	-	-	$13,600	11.2	1.9
6	1	$7,671	366	-	-	-	$4,004	7.5	2.0
7	5	$172,629	2,640	-	6,536	-	$57,700	4.3	3.2
8	10	$224,367	1,503	5,674	4,397	-	$64,100	3.8	3.7
9	12	$94,587	-	32,504	(32,504)	-	$26,653	-2.7	3.8
10	8	$33,778	613	-	-	-	$6,711	2.8	5.3
11	G-N-UP	$51,320	-	900	1,982	-	$6,300	4.0	8.6
12	G-UP	$225,142	(107)	-	6,453	-	$27,300	2.9	8.7
13	N-UP	$122,307	-	-	2,749	-	$13,700	2.3	9.4
14	H-UP	$132,659	-	-	2,988	-	$13,200	2.4	10.6
15	13	$19,400	153	-	-	-	$1,677	1.2	12.2
16	16	$2,415,158	-	36,513	226,569	(263,082)	$160,200	3.1	15.9
17	E-UP	$799,693	5,937	-	-	-	$49,791	0.9	17.0
18	G-V-UP	$27,282	-	-	345	-	$1,500	1.3	19.0
19	14	$147,457	567	-	-	-	$6,203	0.6	25.1
20	G-U-UP	$29,144	-	-	255	-	$1,176	1.0	26.2
21	G-I-UP	$40,123	(78)	-	338	-	$1,381	1.0	30.7
22	J-UP	$382,804	(1,010)	-	3,644	-	$13,037	1.1	31.0
23	I-UP	$382,805	(1,111)	-	3,703	-	$12,322	1.1	32.8
24	D-UP	$310,602	(750)	425	2,249	-	$9,819	1.0	33.4
25	G-P-UP	$31,981	-	598	508	-	$611	2.2	55.3
26	R-UP	$287,199	465	-	-	-	$5,087	0.3	59.7
27	G-E-UP	$115,821	(141)	-	510	-	$1,829	0.5	67.0
28	G-F-UP	$93,779	(90)	-	325	-	$1,164	0.4	85.2
29	G-G-UP	$115,821	(109)	-	393	-	$1,405	0.4	87.1
30	G-J-UP	$1,065,732	-	8,780	8,780	-	$7,200	0.0	147.4
31	4	-	-	-	-	-	-	-	-
32	7	-	-	-	-	-	-	-	-
33	2	$15,985	-	-	-	-	-	-	-

- Upon Failure, Replace Standard Fluorescent Fixture Ballasts with Energy-Efficient Types.
- Reduce Auxiliary Steam Use in Building 349.
- Purchase and Use a Portable Flue Gas Analyzer.
- Implement Various Recommendations for Paint Booths.
- Turn Off Bleeds on Compressed Air Filters

4.3 Low Cost/No Cost ECOs

During the site survey, several low cost/no cost energy conservation opportunities were found. These were grouped by project type and evaluated for cost effectiveness. Each is analyzed separately and the results are contained in Table 4-5. Detailed calculations can be found in Volume II, Appendix B.

Below are the low cost/no cost projects evaluated.

LCNC 1: Close Warehouse Doors When Not in Use
LCNC 2: Turn Off Unneeded Lights
LCNC 3: Insulate Steam Pipes
LCNC 4: Turn Off Equipment When Not in Use
LCNC 5: Repair Strip Curtains at Conveyor Entrance
LCNC 6: Install Motion Sensor Lighting Controls
LCNC 7: Repair Steam Leaks
LCNC 8: Repair Compressed Air Leaks
LCNC 9: Delamp in Overlighted Areas

Table 4-5. Low Cost/No Cost Projects

Number	Cost	Energy Savings (MBtu/yr) Fuel Oil #2	#5/6	Electricity	Energy Cost Savings ($/yr)
LCNC 1	0	172	0	0	$817
LCNC 2	0	0	0	172	$1,874
LCNC 3	$6,946	1,567	-	0	$7,804
LCNC 4	0	0	0	923	$10,087
LCNC 5	$4	543	-	0	$2,704
LCNC 6	$668	0	0	96	$1,043
LCNC 7	$2,164	-	936	0	$4,314
LCNC 8	$5,367	0	0	1,100	$11,750
LCNC 9	$536	0	0	45	$749
TOTALS	$15,685	2,282	936	2,336	$41,142
		3,218			

5.0 ENERGY PLAN

5.1 Project Package

The ECOs listed in Table 4-2 were evaluated for appropriate funding category. The project scope of work listed the following guidelines on this subject.

	Project Cost	Simple Payback
QRIP	\$5,000-\$100,000	≤ 2 yrs.
OSD PIF	> \$100,000	≤ 4 yrs.
PECIP	> \$100,000	≤ 4 yrs.
ECIP	> \$200,000	≤ 10 yrs., SIR > 1.0
MCA	> \$200,000	≤ 25 yrs., ≥ 8 yrs.

Table 5-1 contains the results of the analysis and lists the ECOs by project funding category.

5.2 Energy and Cost Savings

Energy and cost savings for the recommended project funding are listed in Table 5-2. Project capital costs are escalated at 4 percent per year according to the project implementation schedule as discussed below. Energy costs are presented in constant dollars, using FY 92 prices. Projects #5, EMCS for Building 370 and #16, Boiler Conversion to Natural Gas have been programmed by LEAD into the ECIP program. The implementation of all projects yield a total annual energy savings of 53,400 MBtu and annual cost savings equal to \$475,300. Low cost/no cost projects yield another 5,500 MBtu and \$40,000 annual energy and cost savings, respectively. This totals to 58,900 MBtu and \$515,300 annual savings, which represents reductions of 12 percent and 18 percent, respectively when compared to FY 90 values. Figures 5-1 and 5-2 show energy use and cost, respectively, at LEAD before and after implementation of these projects.

5.3 Project Schedule

Project implementation dates are estimated as follows:

QRIP, OSD PIF	FY 93
ECIP, MCA	FY 95

Following this schedule, Figures 5-3 and 5-4 were developed to show the impact implementation the recommended projects would have on energy use and cost, respectively, at LEAD.

Table 5-1. Project Funding List

Funds	ECO ID	Project Description
QRIP	1	Compressed air valve replacement (Building 350)
	6	Heat recovery from condensate (Building 350)
	9	Paint booth fan controls (Buildings 37, 350 and 370)
	11	Blast booth fan cut off (Buildings 37 and 350)
	15	Modular offices (Buildings 6S, 8, 9)
OSD PIF	3	Dip tank covers (Buildings 1, 37, 350, 370)
	10	Paint booth air flow control (Buildings 320, 350)
ECIP (1)	16	Boiler conversion to natural gas (Building 349)
	5	EMCS in Building 370

(1) Submitted by LEAD as ECIPs.

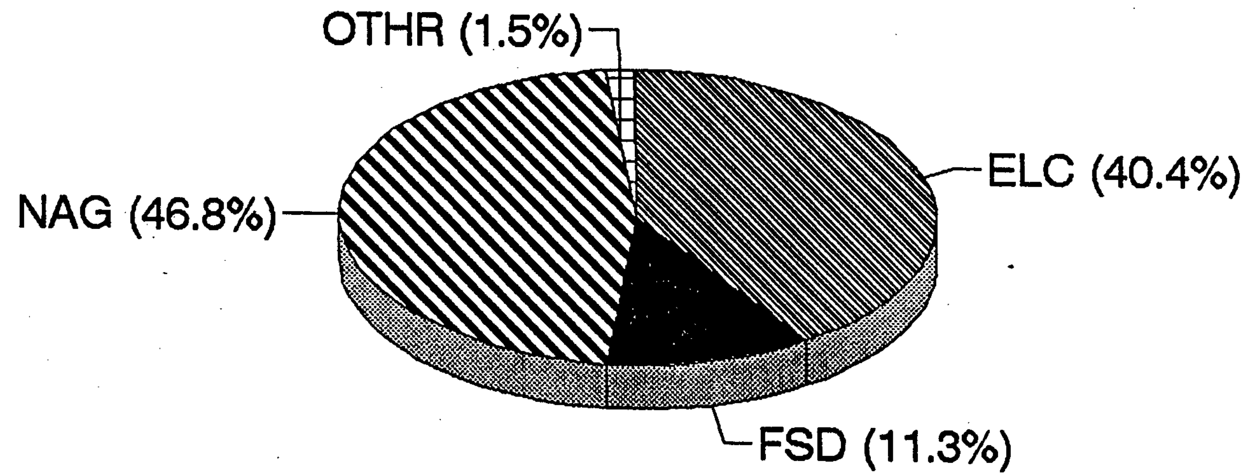
Table 5-2. Project Energy and Cost Savings

No.	Project #	ECO Names	Construction Cost Plus SIOH(1)	Annual Energy Savings MBtu	Annual Energy Savings $(2)	Project Funding	Project Year
1	9	Paint booth fan control	$5,254	5,019	$22,900	QRIP	93
2	11	Blast booth fan cut off	$7,450	1,610	$17,613	QRIP	93
3	6	Heat recovery from condensate	$2,766	938	$4,100	QRIP	93
4	3	Dip tank covers with exhaust fan controls	$214,857	28,530	$137,400	OSD PIF	93
5	15	Modular offices	$26,608	2,755	$13,600	QRIP	93
6	1	Compressed air valve replacement	$8,285	366	$4,004	QRIP	93
7	5	EMCS in Building 370	$194,184	9,176	$57,700	ECIP	95
8	10	Paint booth air flow control	$242,367	11,574	$64,100	OSD PIF	93
9	16	Boiler conversion to natural gas	$2,704,976	0	$160,200	ECIP	95
TOTALS			$3,406,747	53,400 (3)	$475,300 (3)		

(1) Escalated to year of implementation.
(2) Energy costs are in constant FY92 dollars.
(3) Total does not equal to column sum due to project synergism effects.

Letterkenny Army Depot

Energy Use After Project Implementation



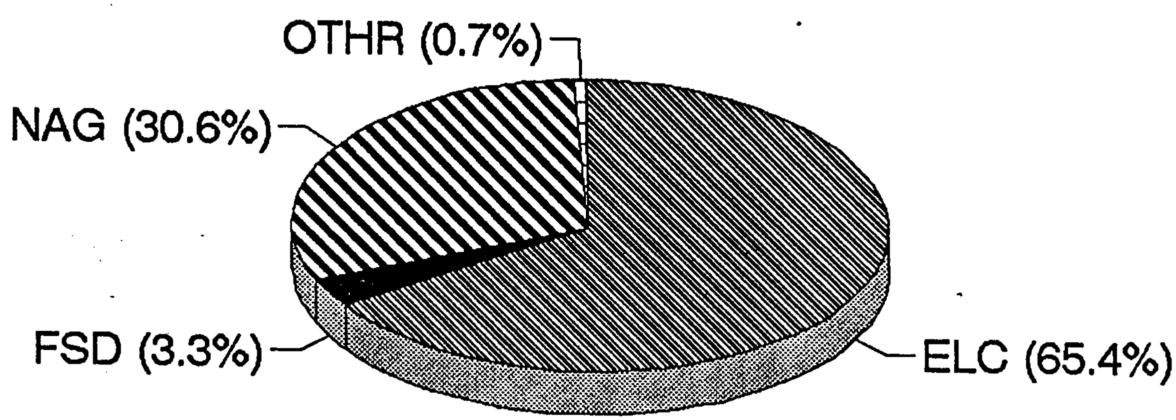
Total Use = 413,400 MBtu

Does not include mobility fuels.

Figure 5-1

Letterkenny Army Depot

Energy Cost after Proj. Implementation



Total Use = $ 2,800,000

Does not include mobility fuels.

Figure 5-2

Letterkenny Army Depot
Effects of Project Implementation

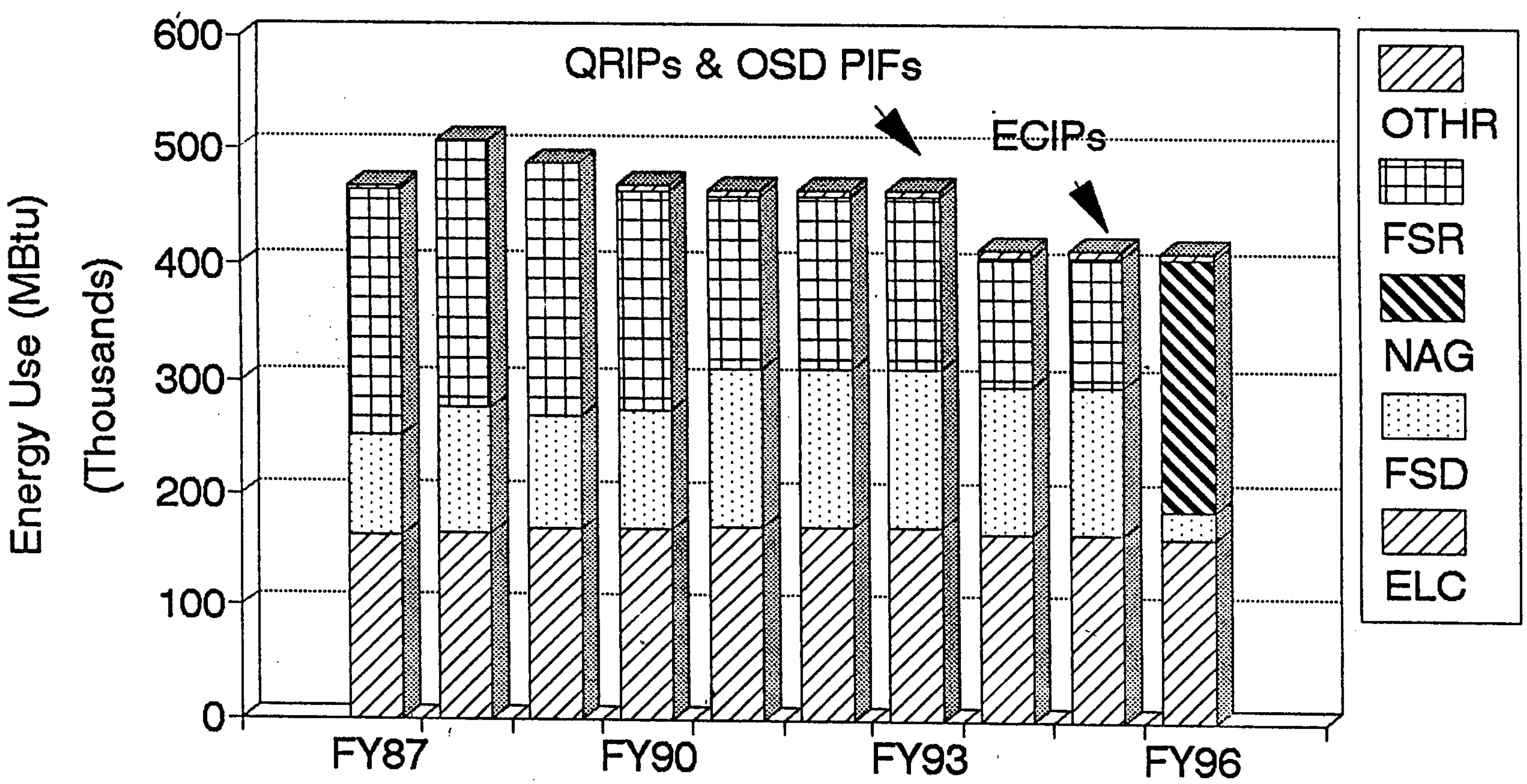


Figure 5-3

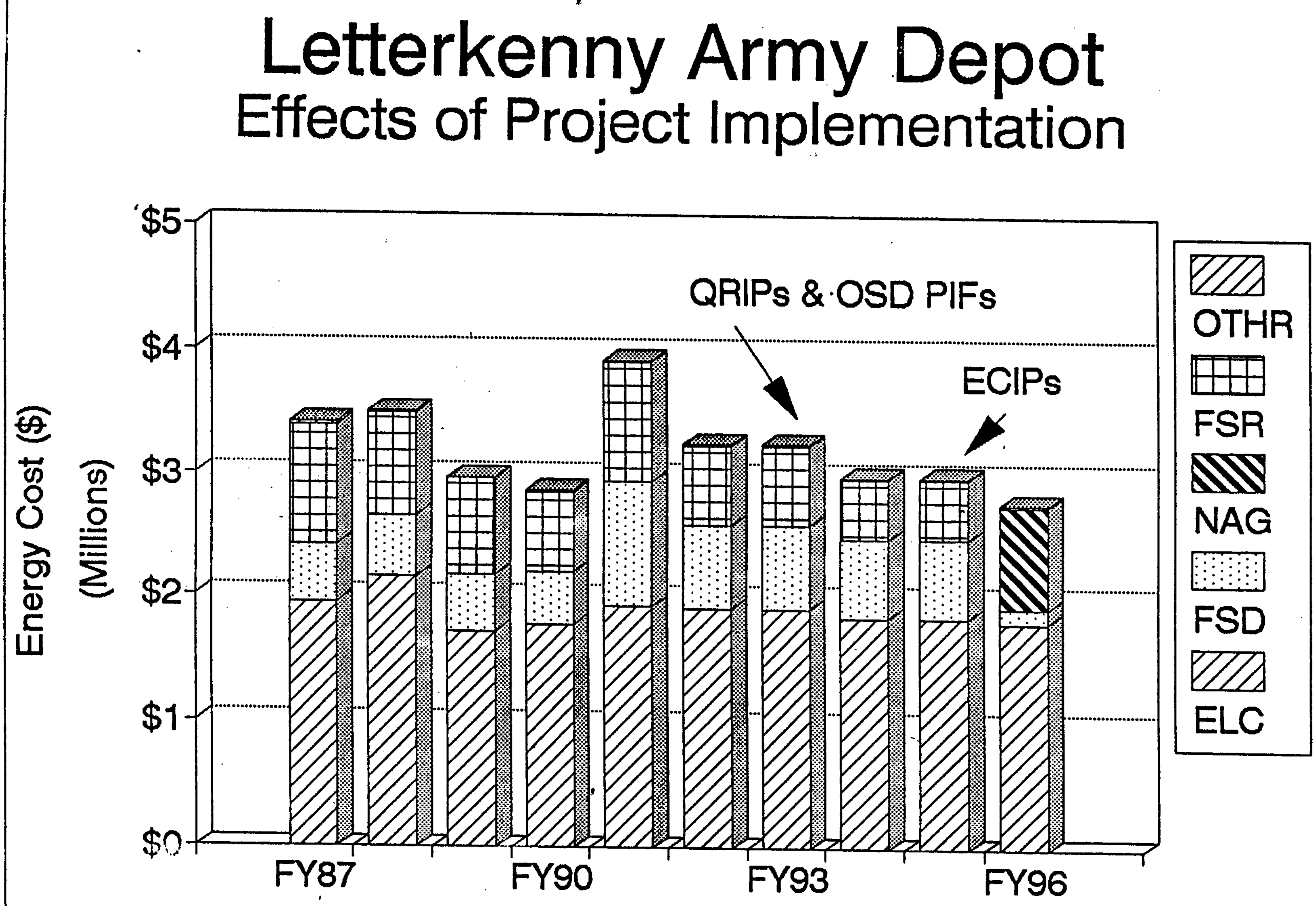

Letterkenny Army Depot
Effects of Project Implementation
Energy Cost ($)
(Millions)
$5
$4
$3
$2
$1
$0
FY87
FY90
FY93
FY96
QRIPs & OSD PIFs
ECIPs
OTHR
FSR
NAG
FSD
ELC

Figure 5-4

1.0 INTRODUCTION

1.1 Authorization

The Energy Engineering Analysis Program (EEAP), Energy Survey of Army Industrial Facility (ESAIF), Letterkenny Army Depot, Pennsylvania was authorized by the Department of the Army, Norfolk District Corps of Engineers, under Contract Number DACA65-91-C-0071.

1.2 Objectives

The objectives of this contract, as explained in the Detailed Scope of Work (Appendix A in Volume II) of the contract are as follows:

A. Perform a complete energy audit and analysis of the industrial facility.

B. Review, use and incorporate applicable data and results of related energy conservation studies, past and current.

C. Perform a site survey to ensure that all methods of energy conservation which are practical have been considered.

D. Identify all Energy Conservation Opportunities (ECOs), including low cost/no cost ECOs and perform a complete evaluation of each.

E. Prepare programming and implementation documentation for all justifiable ECOs.

F. List and prioritize all recommended ECOs.

G. Prepare a comprehensive report which will document the work accomplished, the results and the recommendations.

1.3 Phases of Work

The work to be performed under the contract has been divided into three phases:

- Phase I--Field Investigation and Data Gathering.
- Phase II--Data Analysis. Analysis of data, identification of potential projects, performance of feasibility and economic studies and preparation of Life Cycle Cost Analysis forms. During this phase, all potential projects which produce energy and/or dollar savings will be identified and evaluated as to their

technical and economical feasibility. Project will be ranked according to the highest saving investment ratio (SIR) value.

- Phase III--Report Preparation. Complete documentation of work accomplished. Project documentation for all justifiable ECOs.

1.4 Submission Requirements

As outlined in the contract, the study is divided into three major submissions.

A. Interim Submittal
B. Prefinal Submittal
C. Final Report

1.5 Work Accomplished

An entrance meeting was held with the Chief of the Operations and Maintenance Division, the Chief of Production Equipment Maintenance and representatives of the Energy Office and Boilers/Heating on February 26, 1991 to discuss the scope of work, current energy initiatives at LEAD and work plans and schedules for the field survey.

Field surveys of the industrial facilities were performed from February 25, 1991 to March 1, 1991. During that time, a team of engineers from Reynolds, Smith and Hills, Inc. (RS&H) performed tests, observations and interviews with operating and maintenance personnel in industrial processes.

The exit meeting was held with the Chief of Operations and Maintenance Division on March 1, 1991.

Since that time, work has been performed in the analysis and documentation phases of the project. This included energy data and linear regression analyses, ECO evaluation, Life Cycle Cost Analysis, and documentation of the results and site survey observations. The results of these efforts formed the Interim Submittal.

Comments on the Interim Report were received and discussed at a review conference at Letterkenny Army Depot on September 5, 1991. Responses to the

comments were incorporated into the Prefinal Report. Other new information for the Prefinal Report includes the Executive Summary, Section 5.0, Energy Plan, in Volume I and Volume IV Programming Documents.

Minor corrections were made to the Prefinal Report and then transmitted to the scope of work mailing list in January 1992. The Operation and Maintenance Energy Savings Course was accomplished on January 21, 1992.

1.6 Report Organization

The report consists of an Executive Summary and four volumes. Volume I, the Narrative Report, contains the results of all of the site surveys, analysis and project development. All backup data and calculations are found in Volume II. The site survey notes are in Volume III, and project documentation forms necessary for receiving funding are in Volume IV.

Volume I is the Narrative Report and its organization is explained here. Following a brief introduction in Section 1.0, the existing conditions at LEAD are discussed in Section 2.0. This includes a description of the installation, current and past energy use patterns, a regression analysis determining the impact of weather and production on the energy use at LEAD and a review of previous energy studies. Section 3.0 describes the techniques used to perform this study. Section 4.0 contains the results of the analysis of the energy conserving opportunities (ECOs), Low Cost/No Cost ECOs and solar evaluations, and operation and maintenance savings. The ECO Implementation Plan and the effects on energy use at LEAD are located in Section 5.0.

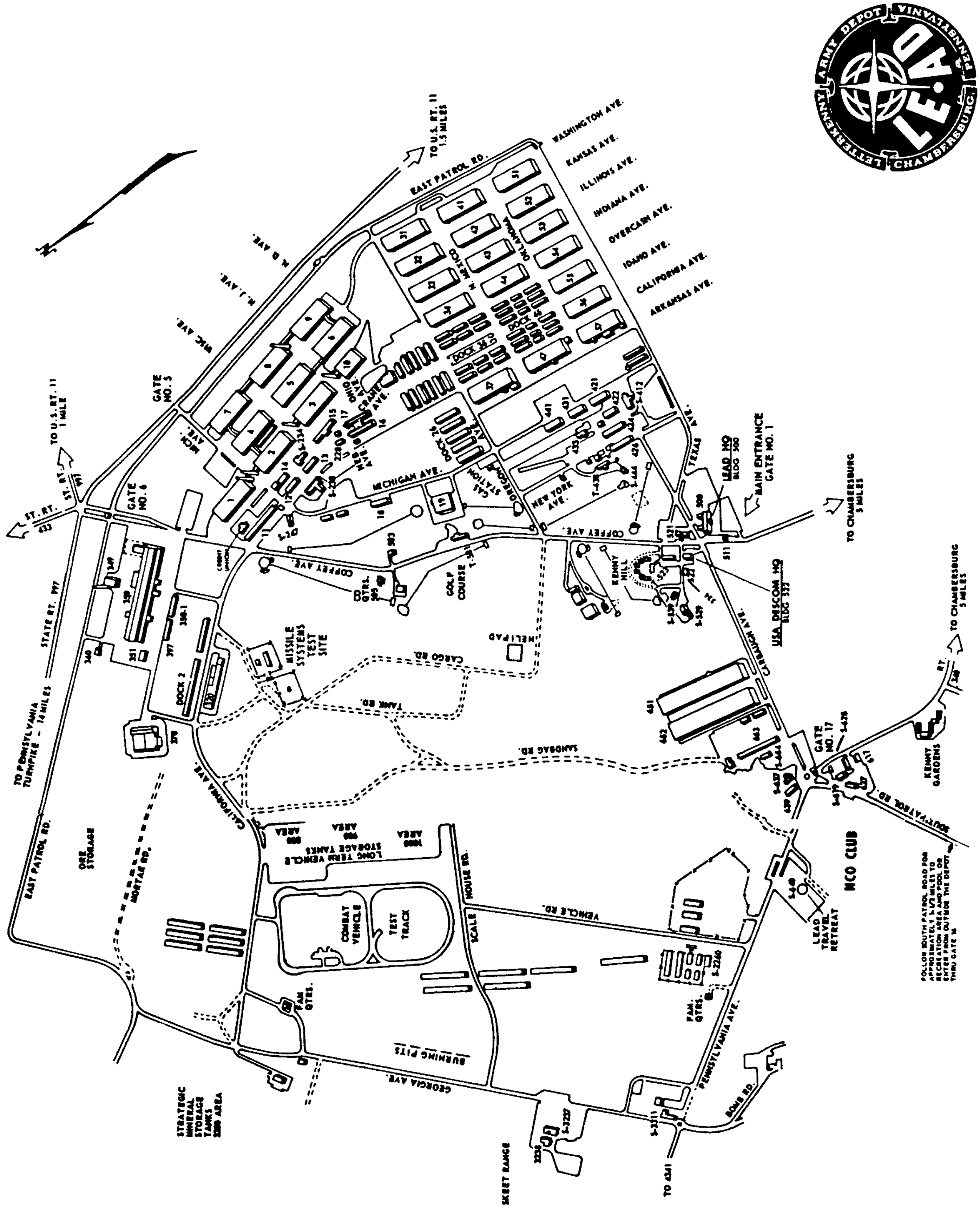

LETTERKENNY ARMY DEPOT CHAMBERSBURG, PENNSYLVANIA
LEAD
TO U.S. RT. 11 1.5 MILES
EAST PATROL RD.
WASHINGTON AVE.
KANSAS AVE.
ILLINOIS AVE.
INDIANA AVE.
OVERCASH AVE.
IDAHO AVE.
CALIFORNIA AVE.
ARKANSAS AVE.
N. D. AVE.
N. J. AVE.
WISC. AVE.
GATE NO. 5
TO U.S. RT. 11 1 MILE
ST. RT. 997
ST. RT. 433
GATE NO. 6
MICHIGAN AVE.
NEW YORK AVE.
TEXAS AVE.
LEAD HQ BLDG 500
MAIN ENTRANCE GATE NO. 1
TO CHAMBERSBURG 5 MILES
COFFEY AVE.
GOLF COURSE
KENNY HILL
USA DESCOM HQ BLDG 322
CATERPILLAR AVE.
HELIPAD
CARGO RD.
MISSILE SYSTEMS TEST SITE
TANK RD.
STATE RT. 997
TO PENNSYLVANIA TURNPIKE - 14 MILES
DOCK 2
SANDBAG RD.
GATE NO. 17
KENNY GARDENS
TO CHAMBERSBURG 5 MILES
SOUTH PATROL RD.
NCO CLUB
LEAD TRAVEL RETREAT
LONG TERM VEHICLE STORAGE TANKS
ORE STORAGE
MORTAR RD.
EAST PATROL RD.
COMBAT VEHICLE
TEST TRACK
SCALE HOUSE RD.
VEHICLE RD.
FAM. QTRS.
BURNING PITS
GEORGIA AVE.
PENNSYLVANIA AVE.
BOMB RD.
STRATEGIC MINERAL STORAGE TANKS 2200 AREA
SKEET RANGE
TO 4341

FIGURE 2-1

2.0 EXISTING CONDITIONS

2.1 Installation Description

Letterkenny Army Depot is located north of I-85 in South Central Pennsylvania, about five miles north of Chambersburg and eight miles southwest of Shippensburg. The facility was built in 1942 for ordnance storage and tank maintenance during World War II. The facilities at LEAD have evolved and improved but the basic mission is still supply, ammunition and maintenance. The ten directorates at LEAD which combine to perform this mission are:

- Maintenance
- Ammunition
- Supply
- Quality Assurance
- Resource Management
- Information Management
- Contracting
- Engineering and Logistics
- Personnel and Community Activities
- Law Enforcement and Security

The LEAD facilities cover over 20,000 acres of land and includes about 980 buildings. The employment level as of September 1990 was 4,656. Figure 2-1 is a site plan of LEAD and shows the location of the various production facilities. The industrial areas (and Directorate) covered under the scope of work for this study include:

- Vehicle Maintenance (Maintenance)
- Electronic Systems Maintenance (Maintenance)
- Engine/Transmission Maintenance (Maintenance)
- Vehicle Care and Painting (Supply)
- Major Item Storage (Supply)
- Secondary Item Storage and Distribution (Supply)
- General Plant
    - Process Heating Systems
    - Space Heating Systems
    - Water Treatment Facilities

2.2 Process Descriptions

The following process areas are described in this section.

- o Vehicle Maintenance
- o Electronic Systems Maintenance
- o Engine/Transmission Maintenance
- o Vehicle Care and Painting
- o Major Item Storage
- o Secondary Item Storage and Distribution
- o General Plant

2.2.1 Vehicle Maintenance. Tracked and wheeled combat vehicles are refurbished, rebuilt and repainted at LEAD. The vehicles are "steam" cleaned in Building 351 prior to disassembly. The vehicles are then moved into the main section of Building 350 where they are completely disassembled. The engine and power train are transported to Building 37 for maintenance. Mechanical, electrical and body work are performed in the main portion of Building 350. Parts repair and fabrication are accomplished in the machine shop area of Building 350 (Figure 2-2). Numerous floor mounted and portable power tools, compressed air equipment and dip tanks are used in these areas. Some of the dip tanks are heated by steam which is fed from the boilers in Building 349. After all of the individual parts are reconditioned, they are reassembled and the vehicle is then painted. Paint booths, electric drying ovens, blast booths and dip tanks are major energy consuming process equipment.

Space heating is supplied by overhead steam unit heaters with individual thermostats. Process area lighting is primarily high pressure sodium.

2.2.2 Electronic Systems Maintenance. Missiles and their control systems are refurbished and rebuilt in Building 370. The first step is to disassemble the electronic control equipment. The system's components are then tested, repaired and then reassembled. The reassembled system is then tested and tuned as a unit prior to shipment (Figure 2-3). Power tools, dip tanks, paint booths, blast booths and frequency converters are major energy using equipment used for the processes in Building 370.

LEAD Process Flow Diagram

VEHICLE MAINTENANCE

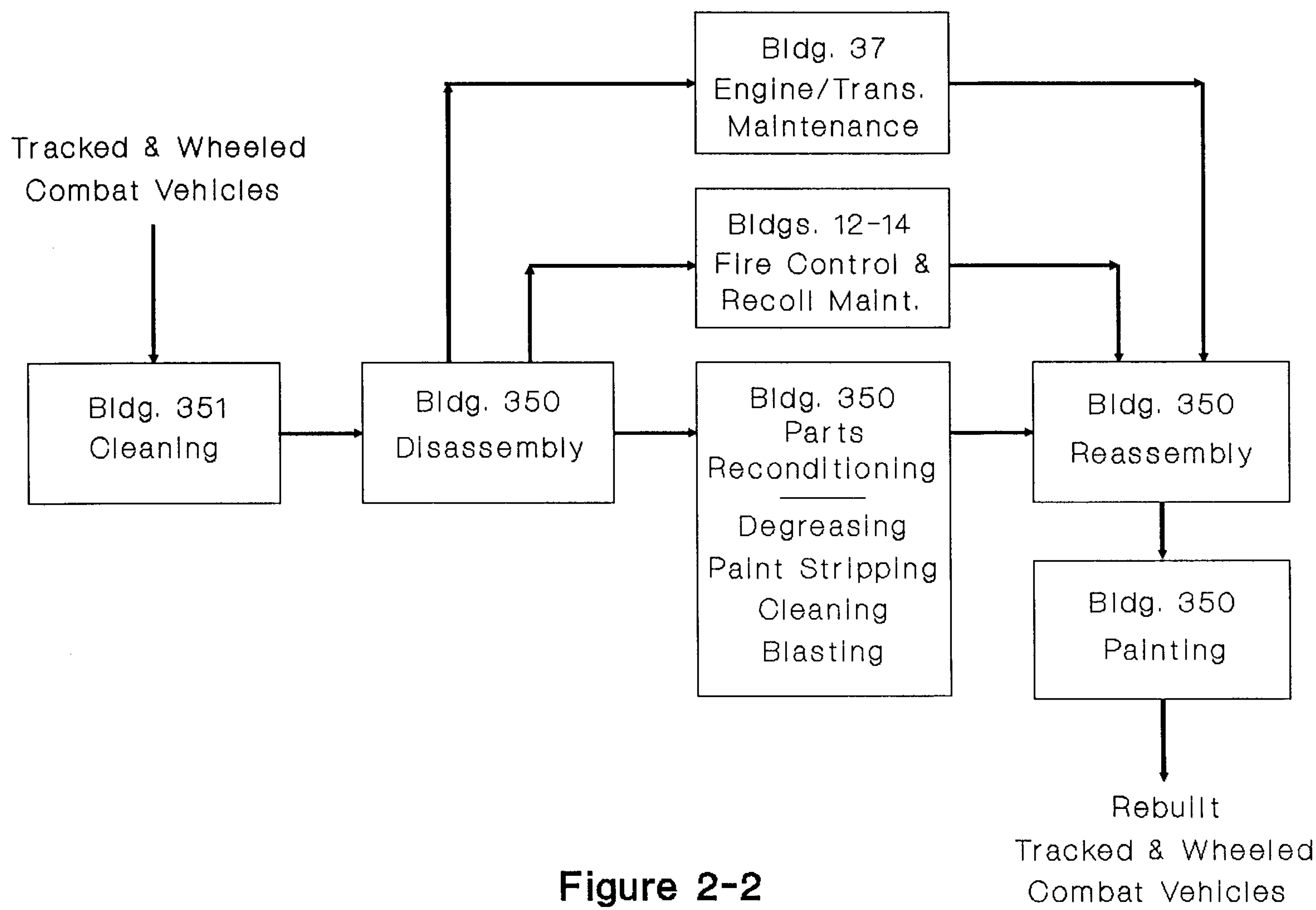


Figure 2-2

LEAD Process Flow Diagram

ELECTRONIC SYSTEMS MAINTENANCE

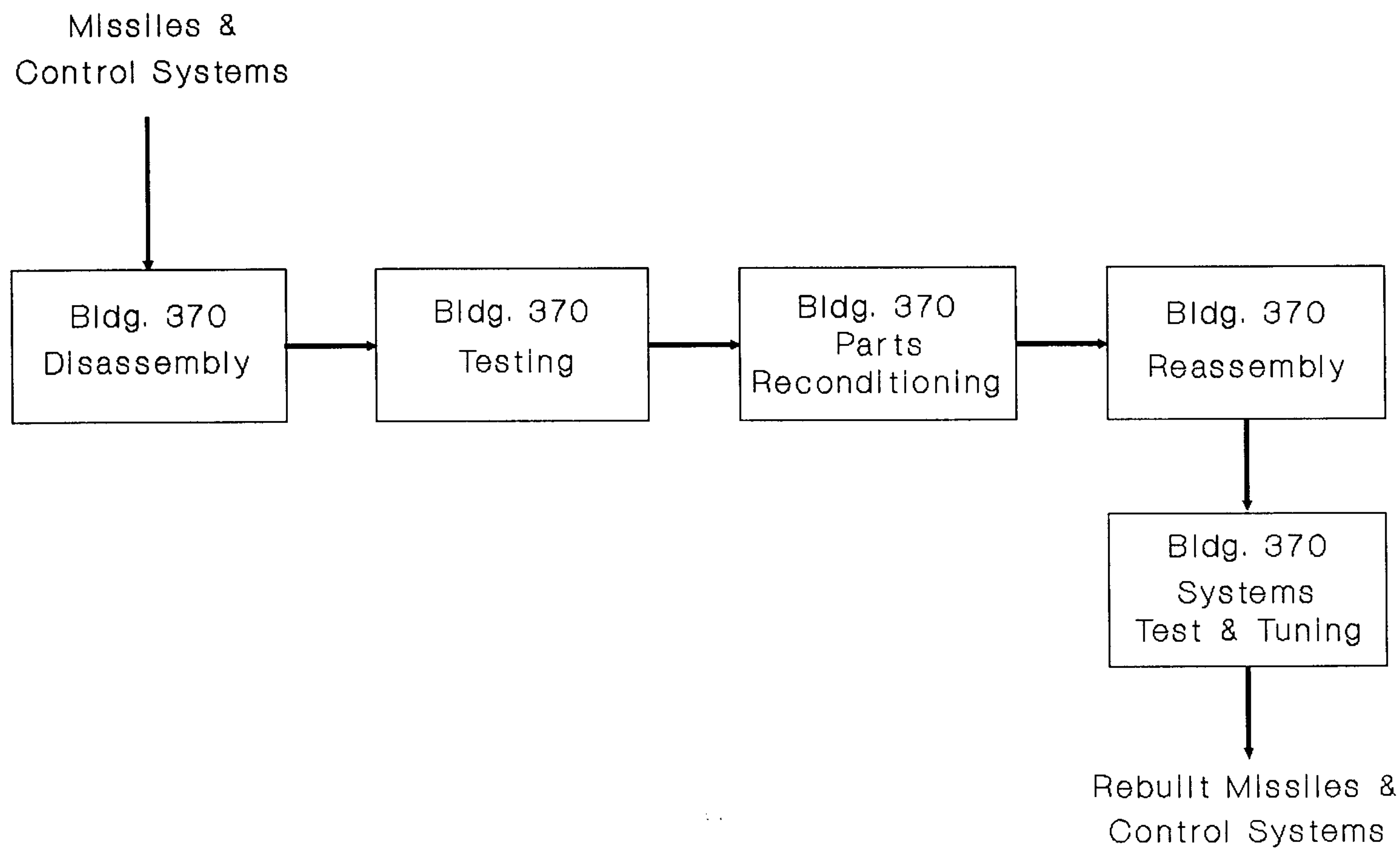


Figure 2-3

Due to the sensitive nature of the electronic control and testing systems, Building 370 is heated and cooled 24 hours per day, 365 days per year. Heating is provided by steam from the boilers in Building 349. The cooling system consists of two centrifugal chillers. Numerous air handling units with steam and chilled water coils are used to distribute conditioned air to the various areas of the building. Process area lighting is a combination of fluorescent, incandescent and metal halide. High pressure sodium lighting is utilized in the warehouse area.

Most of the electronic missile control and testing systems operate on 400-cycle power. There are 15 frequency converters that convert 60-cycle power to 400-cycle power. There are ten are the motor generator-type frequency converters and five are solid state units. Approximately ten of the frequency converters operate 24 hours per day. The remaining units are used for backup purposes.

2.2.3 <u>Engine/Transmission Maintenance</u>. Engines and transmissions are removed during the vehicle rebuild process (Building 350) and transported to Building 37. Some engines and transmissions are also received from off-site customers. The engines and transmissions are "steam" cleaned, disassembled, reconditioned, rebuilt and tested in Building 37 (Figure 2-4). The reconditioning process can include degreasing, paint stripping and "sand" blasting. These processes utilize a large array of floor-mounted and portable power tools, compressed air tools, paint booths, dip tanks and steam cleaning equipment. After reassembly and full load testing, the engines and transmissions are returned to the vehicle rebuild process in Building 350 or shipped to the off-site customers.

Building 37 is heated by overhead steam unit heaters. Lighting is provided primarily using HPS and some fluorescent fixtures.

2.2.4 **<u>Vehicle Care and Painting</u>**. New transport and combat vehicles are repainted in Building 320 (Figure 2-5). The vehicles are first inspected, and minor maintenance is performed if necessary. There are ten mechanical bays and one welding bay used for inspection and maintenance. The vehicles are

LEAD Process Flow Diagram

ENGINE/TRANSMISSION MAINTENANCE

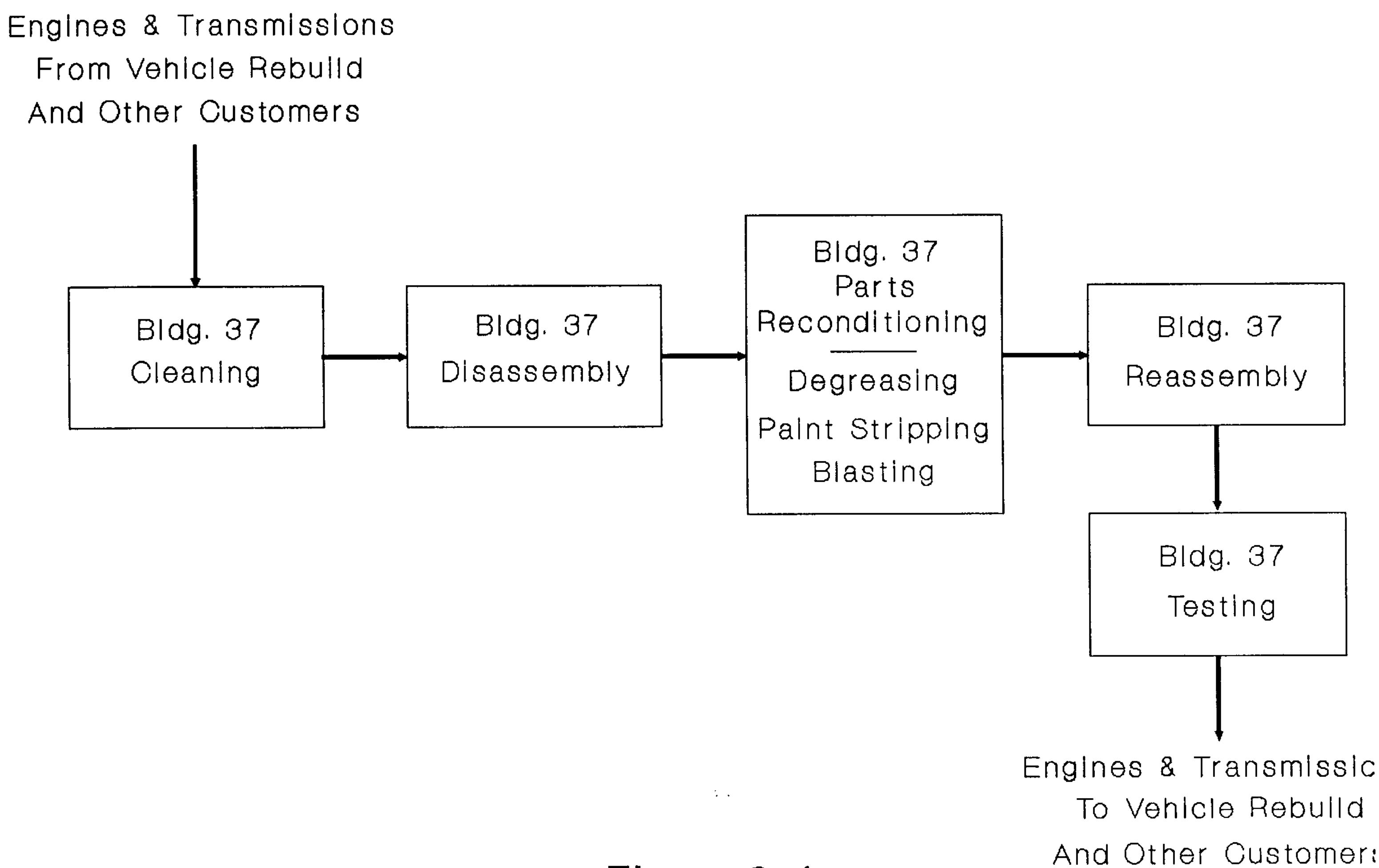


Figure 2-4

LEAD Process Flow Diagram

VEHICLE CARE & PAINT

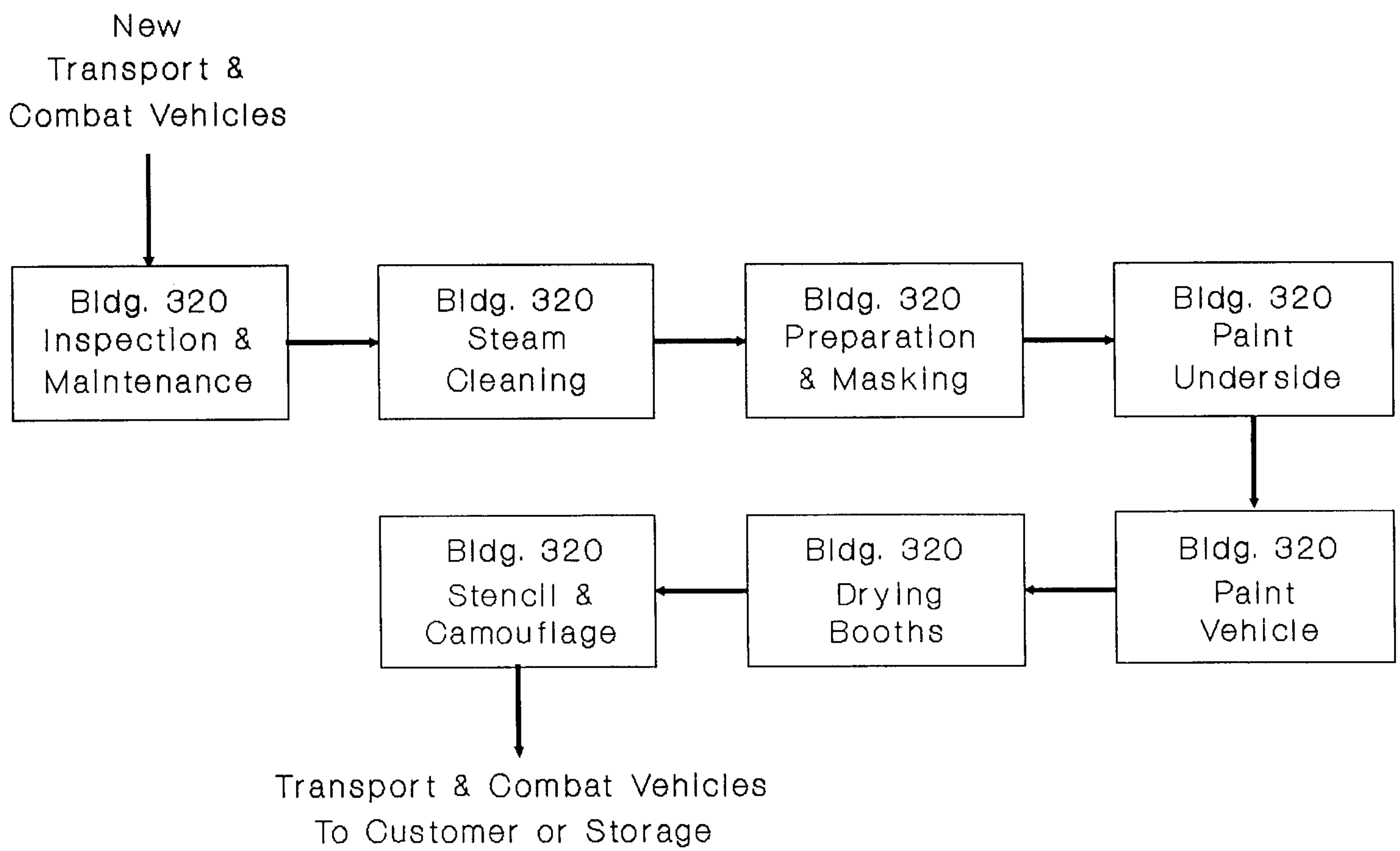


Figure 2-5

then "prepped" for painting, which includes steam cleaning, sanding, grinding and masking.

The first step in the painting process is applying rustproofing, primer and paint to the underside of the vehicle. The vehicle is then moved into a paint booth where the sides and top are painted. After painting, the vehicle is dried in a drying booth.

The final process is stenciling and painting of the camouflage. If any touch-up work is required it is also done in the stencil booths. Upon completion the vehicles are shipped to the customer or stored in the tank farm.

The major energy using process equipment for the Vehicle Care and Painting operation includes three steam-clean bays, two pit spray booths, four paint booths, two drying booths, two stencil (and touch-up) booths and one parts painting booth.

Heating for Building 320 is provided by steam from two York-Shipley boilers located in the mechanical room. Steam is piped to overhead forced-air unit heaters which are controlled by thermostats located on the columns. Process lighting consists of high pressure sodium and fluorescent fixtures.

2.2.5 Major Item Storage. Buildings 31, 32, 34, 41, 44, 47, 52, 53, 55, and 56 are unheated warehouses (Figure 2-6). These ten buildings provide storage for machinery that cannot be damaged by freezing temperatures. Desiccant type dehumidifiers maintain a 50-percent relative humidity to preserve the condition of the stored machinery. Electric strip heaters are used to dry the desiccant beds when they become saturated with moisture. Minimal lighting is provided by mercury vapor fixtures.

Buildings 33, 42, and 43 are heated warehouses. These three buildings are used for storage and assembly of items which can not be exposed to freezing temperatures. Unit heaters and desiccant type dehumidifiers maintain 50-percent relative humidity to preserve the condition of the stored machinery. Electric strip heaters are used to dry the desiccant beds when

LEAD Process Flow Diagram

MAJOR ITEM STORAGE

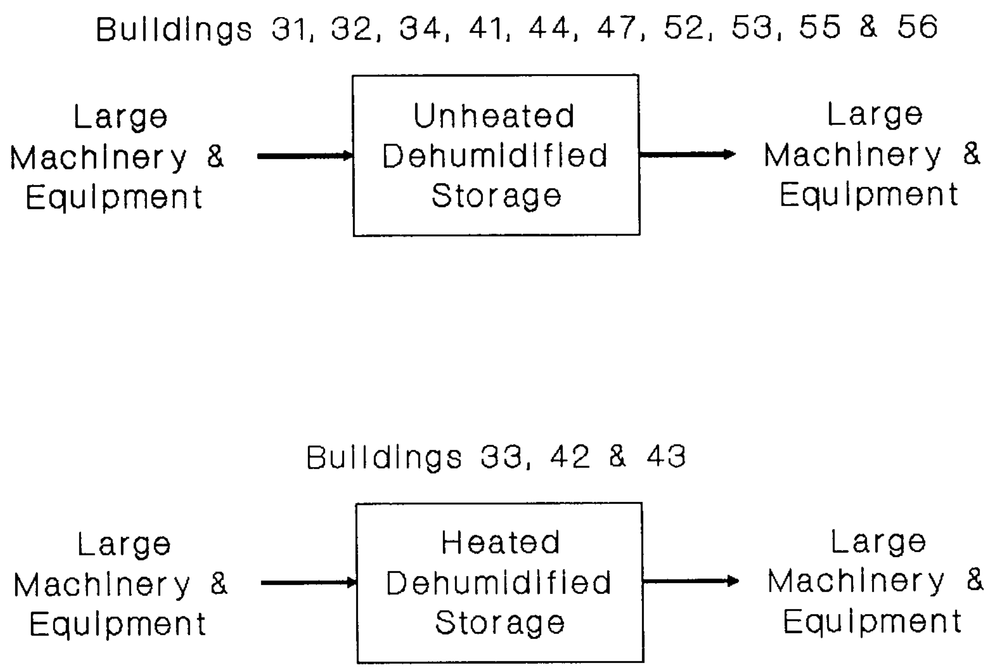


Figure 2-6

they become saturated. Building 43 also has a mission to sort, pack and preserve items before storage.

These buildings are heated by overhead steam-unit heaters. Two-lamp fluorescents are the primary lighting system, but mercury vapor and HPS are also used.

2.2.6 Secondary Item Storage and Distribution. Buildings 2, 4, 5, 6, 7, 8 and 9 are all warehouses connected by a series of conveyors (Figure 2-7). General supply items are received at Building 5. These items are sorted, stored and packed in Buildings 5, 6, 9, 8, 7, 4, and 2. The supply items are then shipped upon request from Building 2. Building 2 is temporarily being used by New Cumberland Army Depot, so shipping operations for LEAD are being conducted from Building 4.

All of the warehouse areas are heated with forced air, steam coil unit heaters. Buildings 6, 7, 8, and 9 also use desiccant type dehumidifiers to maintain a constant relative humidity. Electric strip heaters are used to dry the desiccant beds when they become saturated with moisture.

2.2.7 General Plant. General Plant processes serve the industrial processes at LEAD. General Plant processes include the supply and distribution of potable water, treatment of wastewater and sewer and steam.

Boiler Plants. Winter comfort heating and year-round process heating is supplied by petroleum-generated, saturated, low-pressure steam. Pressures are typically below 20 psig. Both No. 2 and No. 5 fuels are burned. In Building 349, No. 6 fuel is the primary fuel and up to 100 psig saturated steam is produced. Generally, condensate is returned whenever possible in all buildings. The boilers are typically fire tube design. Building 349 boilers are water tube. There are 28 boiler plants, having a total of 43 boilers, supplying 60 buildings (excluding ammo area).

LEAD Process Flow Diagram

SECONDARY ITEM STORAGE AND DISTRIBUTION

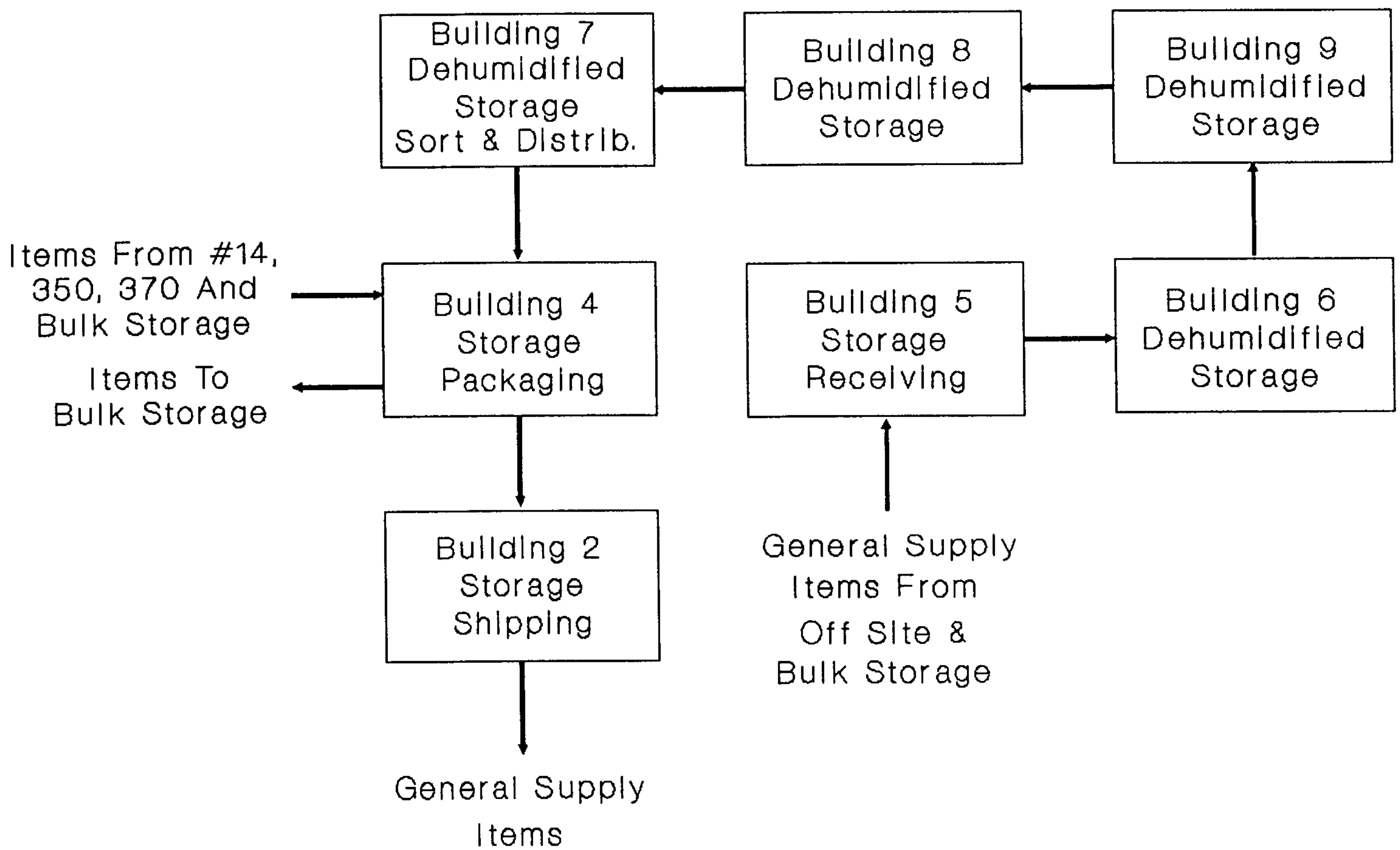


Figure 2-7

BOILER PLANTS SURVEYED

Bldg. #	Number and Size (MBtu/hr)	Fuel	Pressure	Buildings Served	Process Served
1	2/5.0	5	LP	1	Dip Tanks, Space Heat
2	2/2.9	2	LP	2, 4, 7	Space Heat
3	2/5.0	5	LP	3, 5	Space Heat
8	2/5.0	2	LP	6, 8, 9	Space Heat
12	2/2.9	5	LP	12, 13, 14	Space Heat
19	1/2.0	2	LP	19	Space Heat
33	1/2.3	2	LP	33	Space Heat
37N	1/4.2	5	LP	37	Space Heat
37HP	1/4.2	2	HP	37	"Steam" Clean
	1/2.7	2	HP	37	Space Heat, Dip Tanks
37SW	1/8.4	5	LP	37	Space Heat, Dip Tanks
57	2/5.0	5	LP	57	Space Heat
	1/12.6	5	LP	57	Space Heat
320	2/8.4	2	LP	320	Space Heat
320HP	1/1.7	2	HP	320	"Steam" Clean
349	3/26.8	6	HP	350, 370	Dip Tanks, "Steam" Clean
423	3/5.0	5	LP	421, 422, 424, 426, 431, 433, 436, 437	Space Heat

<u>Potable Water</u>. The LEAD drinking water supply comes from the Roxbury Impoundment and it flows by gravity to the Water Treatment Plant, Building 554. Water is stored in two one-million gallon reservoirs. The water is filtered, settled and pumped to two tank towers--100,000 gallons (domestic and process) and 300,000 (fire protection). The elevated towers supply water to users throughout the installation.

Sewage Treatment Plant. Wastewater is received at the Sewage Treatment Plant, Building 2326. Aeration pumps are used to treat about 80,000 gallons per day, Monday through Friday and 25,000 gallons per day on the weekends.

2.3 Historical Energy Use and Costs

2.3.1 Energy Use. Total facility and production energy consumption at LEAD decreased by approximately 7.6 percent from FY 88 through FY 91 (Figure 2-8). The cause for the decrease was because of decreases in use of primary boiler fuels (FSR and FSD), which was related to weather. Electricity consumption, on the other hand, has remained relatively constant, showing a 2.5-percent increase over the same time period.

Monthly consumption of boiler fuels and electricity for FY 88-91 is shown in Figure 2-9. The strong dependence of boiler fuels on weather is readily apparent, although some steam is generated during the summer months for uses other than heating. Electricity use is fairly constant throughout the year, showing that almost all electricity consumption is strictly work related.

Percentages of fuel use for FY 90 are shown in Figure 2-10. The two primary boiler fuels accounted for approximately 63 percent of energy use in that year.

2.3.2 Costs. Total annual costs at LEAD decreased by 18.3 percent from FY 88 through FY 91 (Figure 2-11). In the case of electricity, the changes in cost reflect changes in unit pricing over the same time period (Figure 2-12). The decrease in total boiler fuel costs is a reflection of both decreases in consumption and unit prices.

Monthly energy costs at LEAD are shown in Figure 2-13. As in the case of consumption, boiler fuel costs vary widely, depending on weather. Electricity costs are a significant portion of the monthly costs, and can range from 90 percent of the monthly total to 20 percent (Figure 2-14).

Letterkenny Army Depot
Historical Energy Use

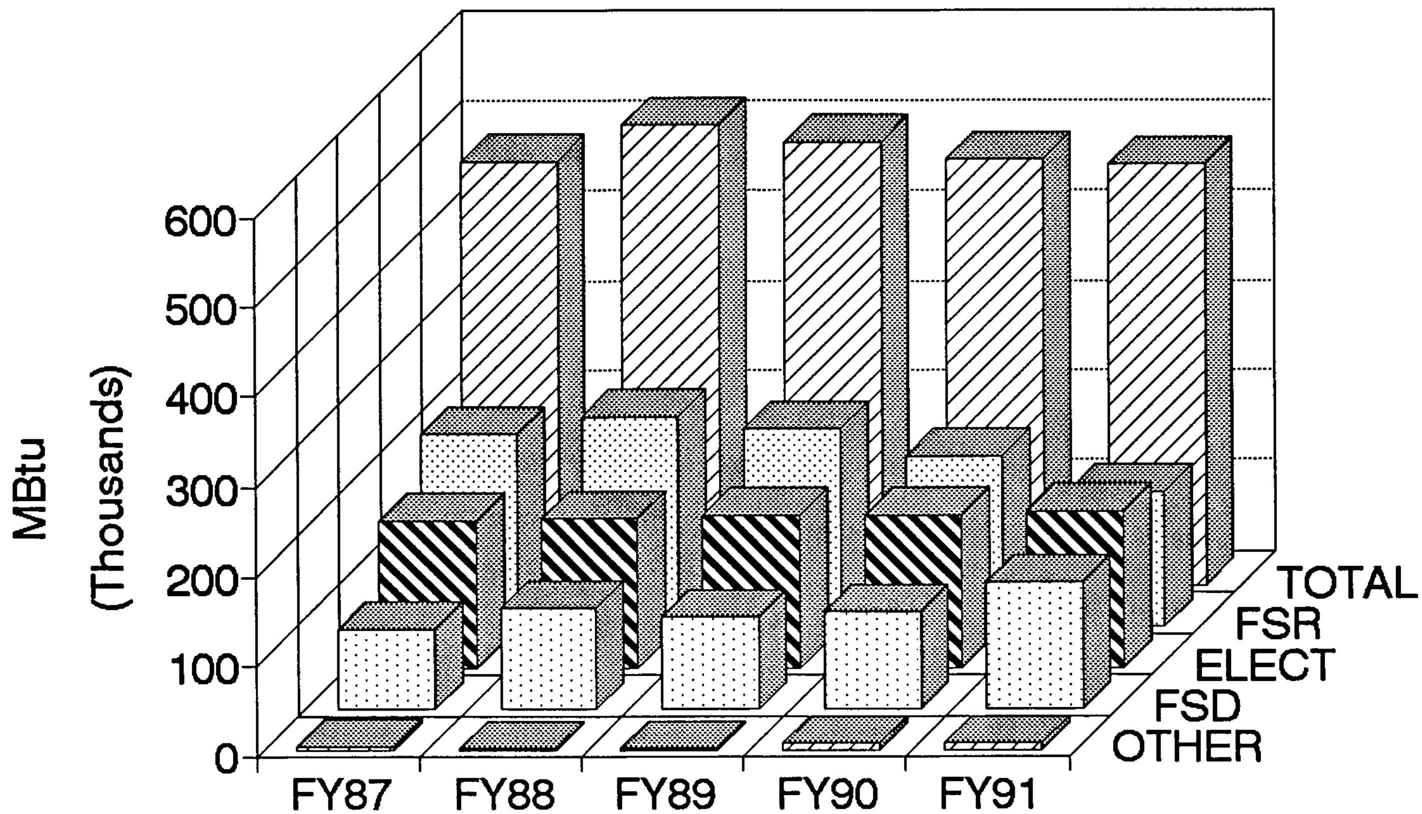
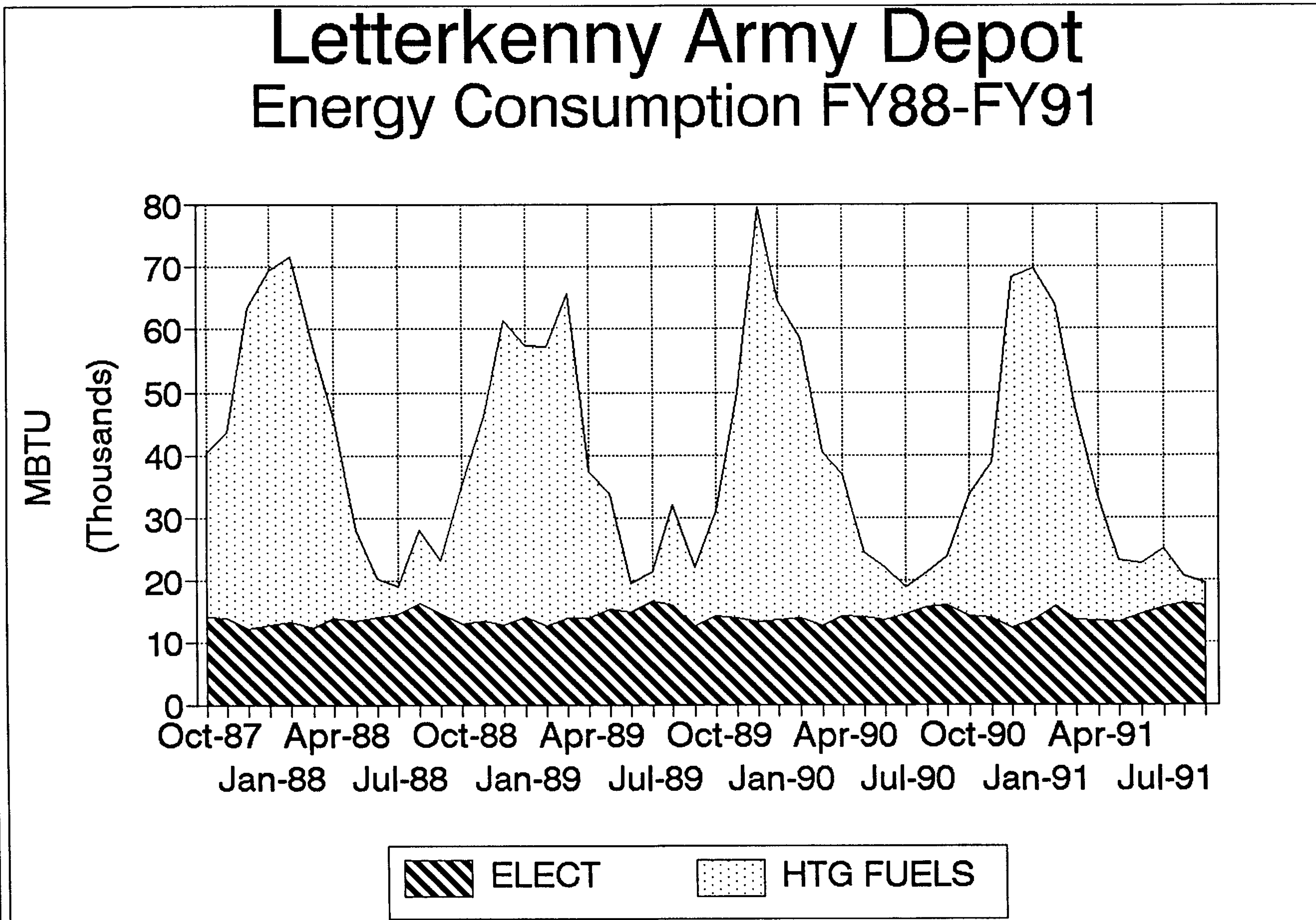


Figure 2-8



Letterkenny Army Depot
Energy Consumption FY88-FY91
MBTU
(Thousands)
80
70
60
50
40
30
20
10
0
Oct-87
Jan-88
Apr-88
Jul-88
Oct-88
Jan-89
Apr-89
Jul-89
Oct-89
Jan-90
Apr-90
Jul-90
Oct-90
Jan-91
Apr-91
Jul-91
ELECT
HTG FUELS

Figure 2-9

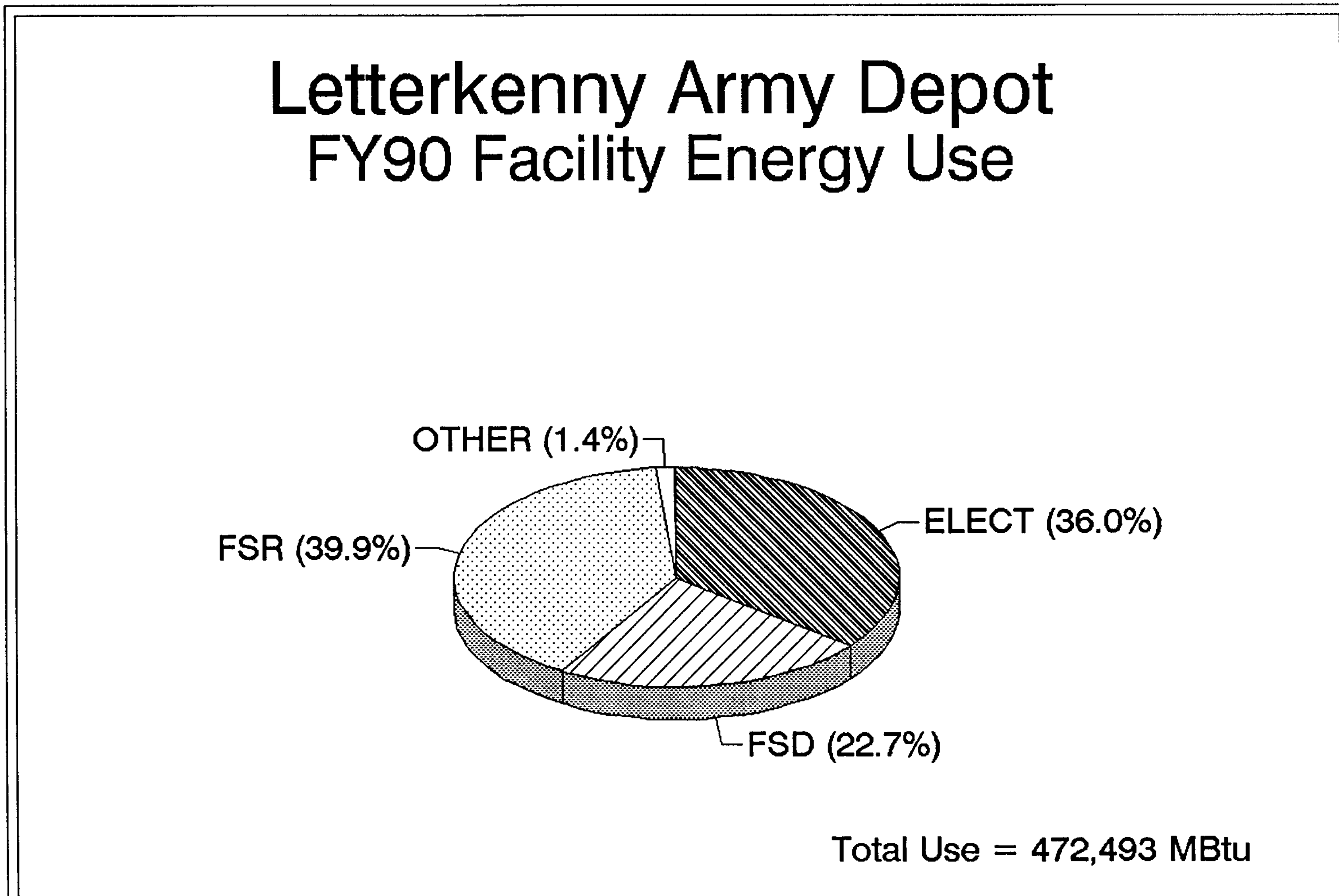

Letterkenny Army Depot
FY90 Facility Energy Use
OTHER (1.4%)
ELECT (36.0%)
FSR (39.9%)
FSD (22.7%)
Total Use = 472,493 MBtu

Figure 2-10

Letterkenny Army Depot
Historical Energy Cost

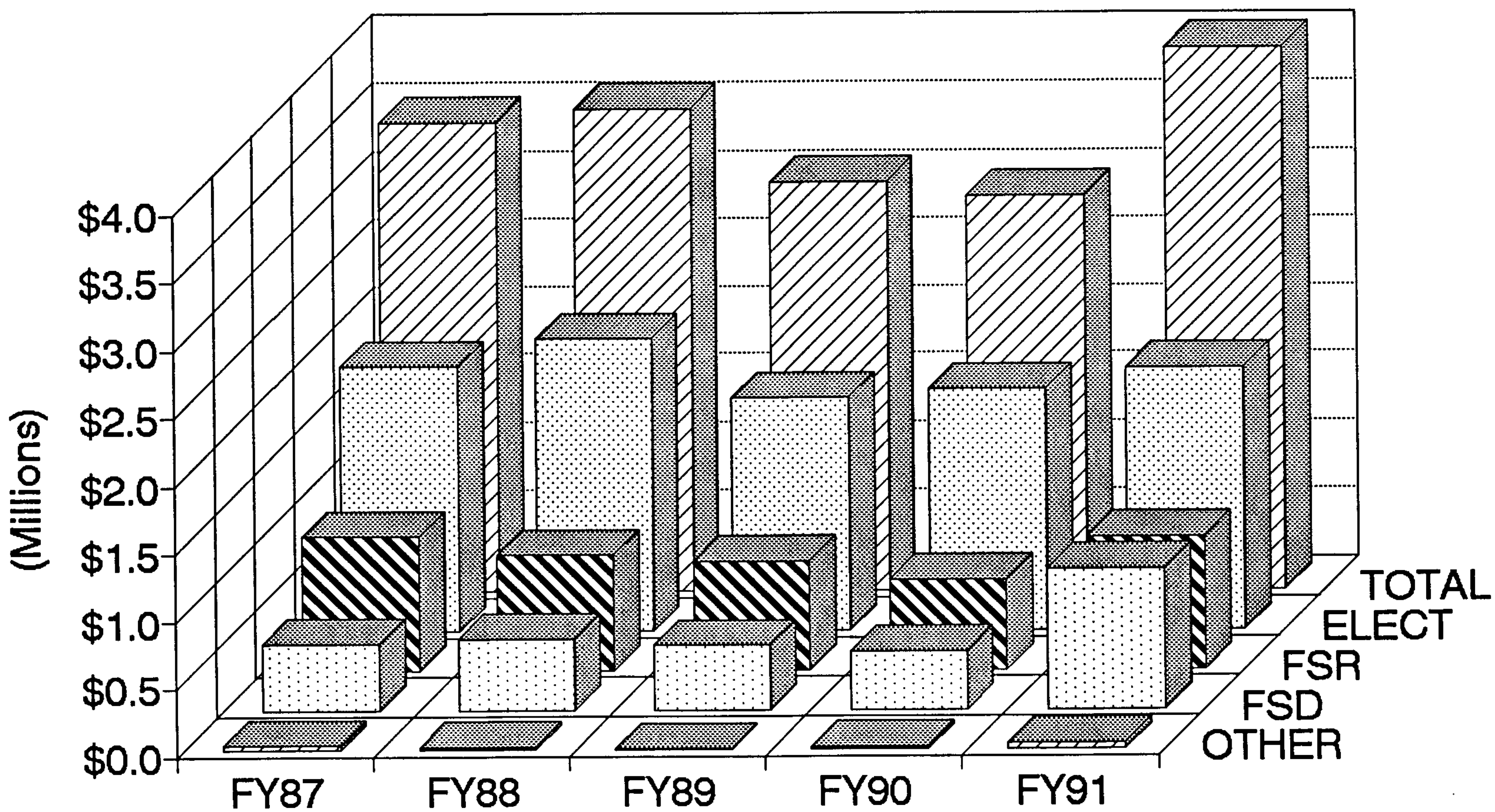


Figure 2-11

Letterkenny Army Depot

Historical Energy Unit Cost

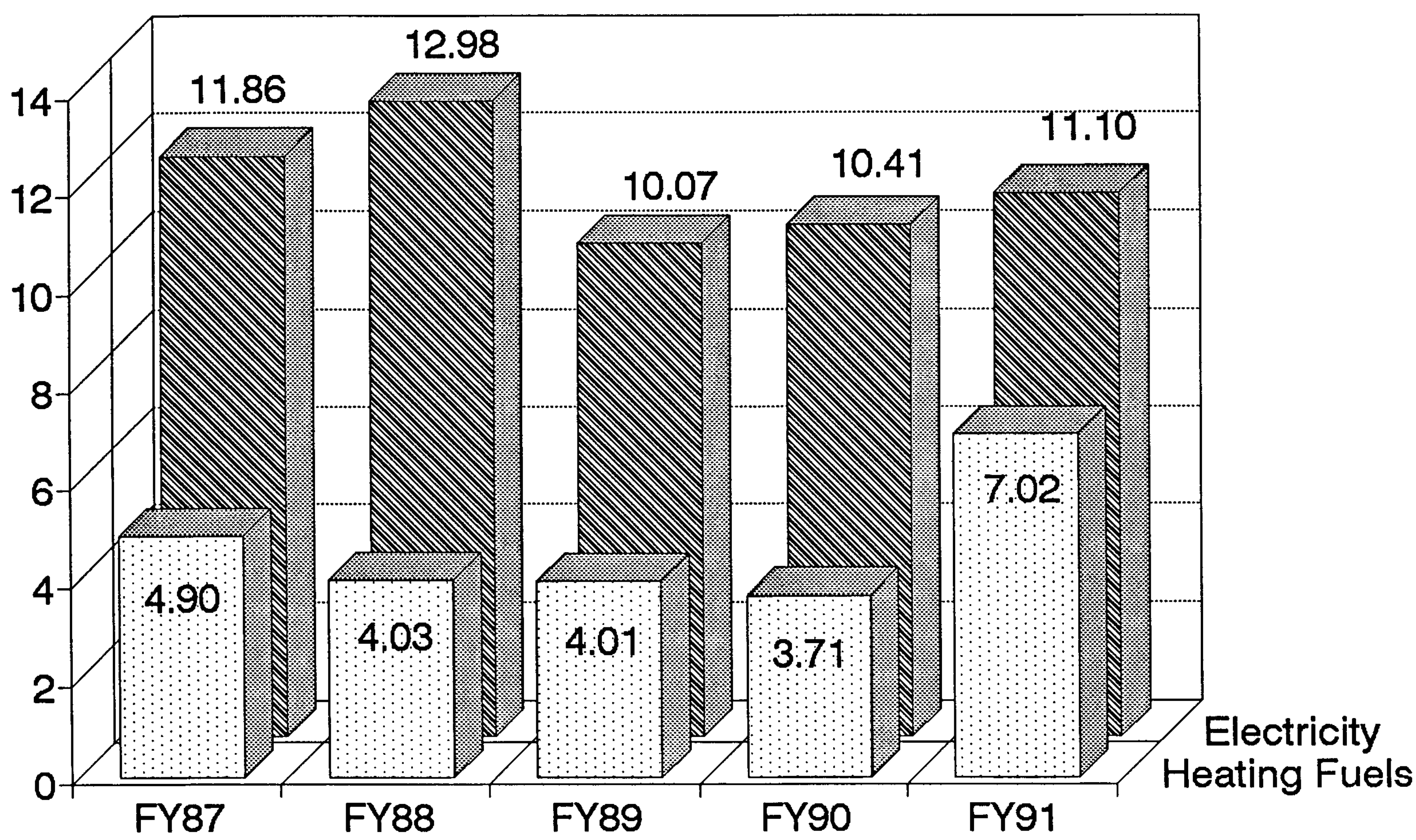


Figure 2-12

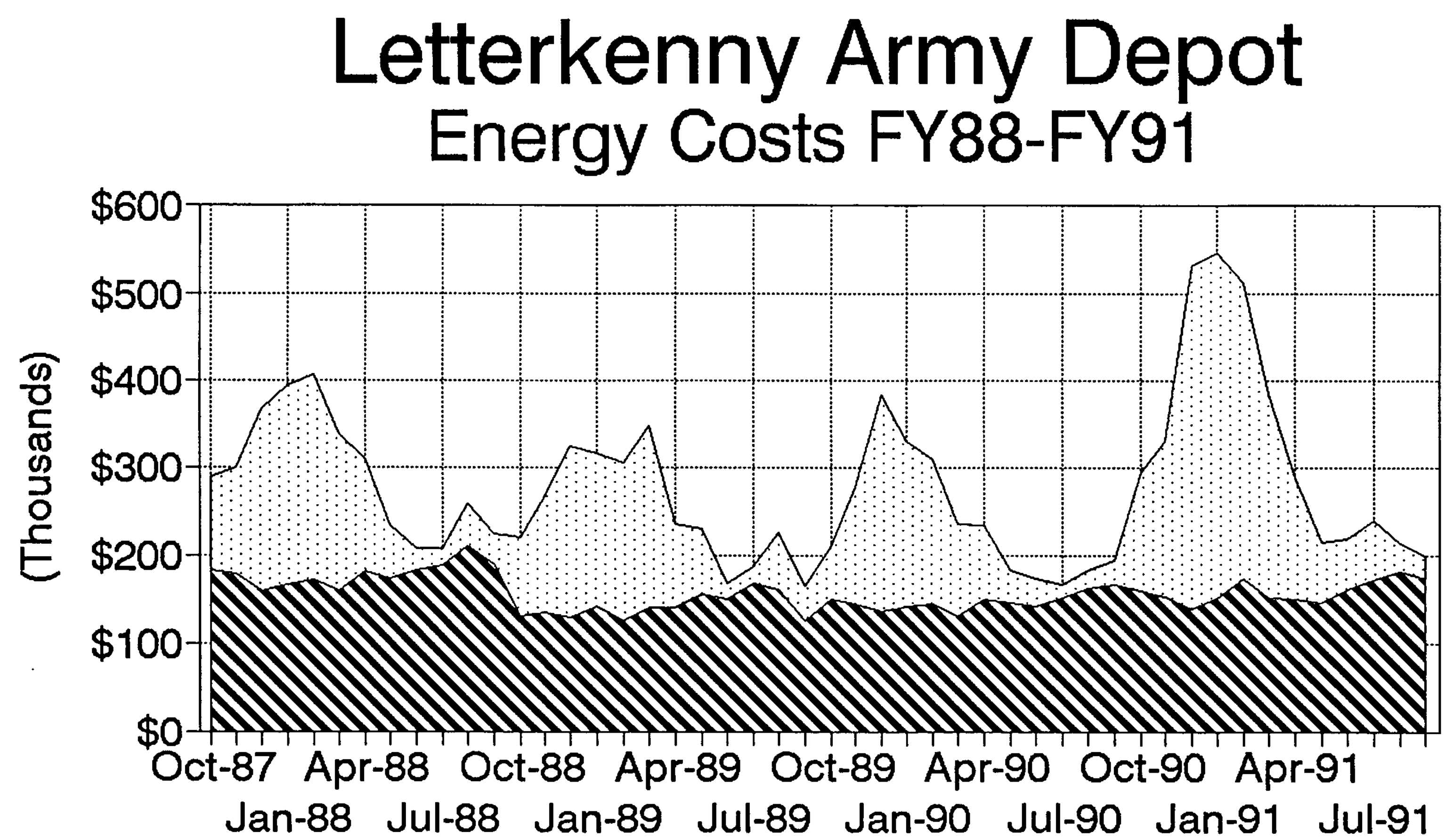

Letterkenny Army Depot
Energy Costs FY88-FY91
(Thousands)
$600
$500
$400
$300
$200
$100
$0
Oct-87
Jan-88
Apr-88
Jul-88
Oct-88
Jan-89
Apr-89
Jul-89
Oct-89
Jan-90
Apr-90
Jul-90
Oct-90
Jan-91
Apr-91
Jul-91
ELECT
HTG FUELS

Figure 2-13

Letterkenny Army Depot
Electricity Cost % FY88-FY91

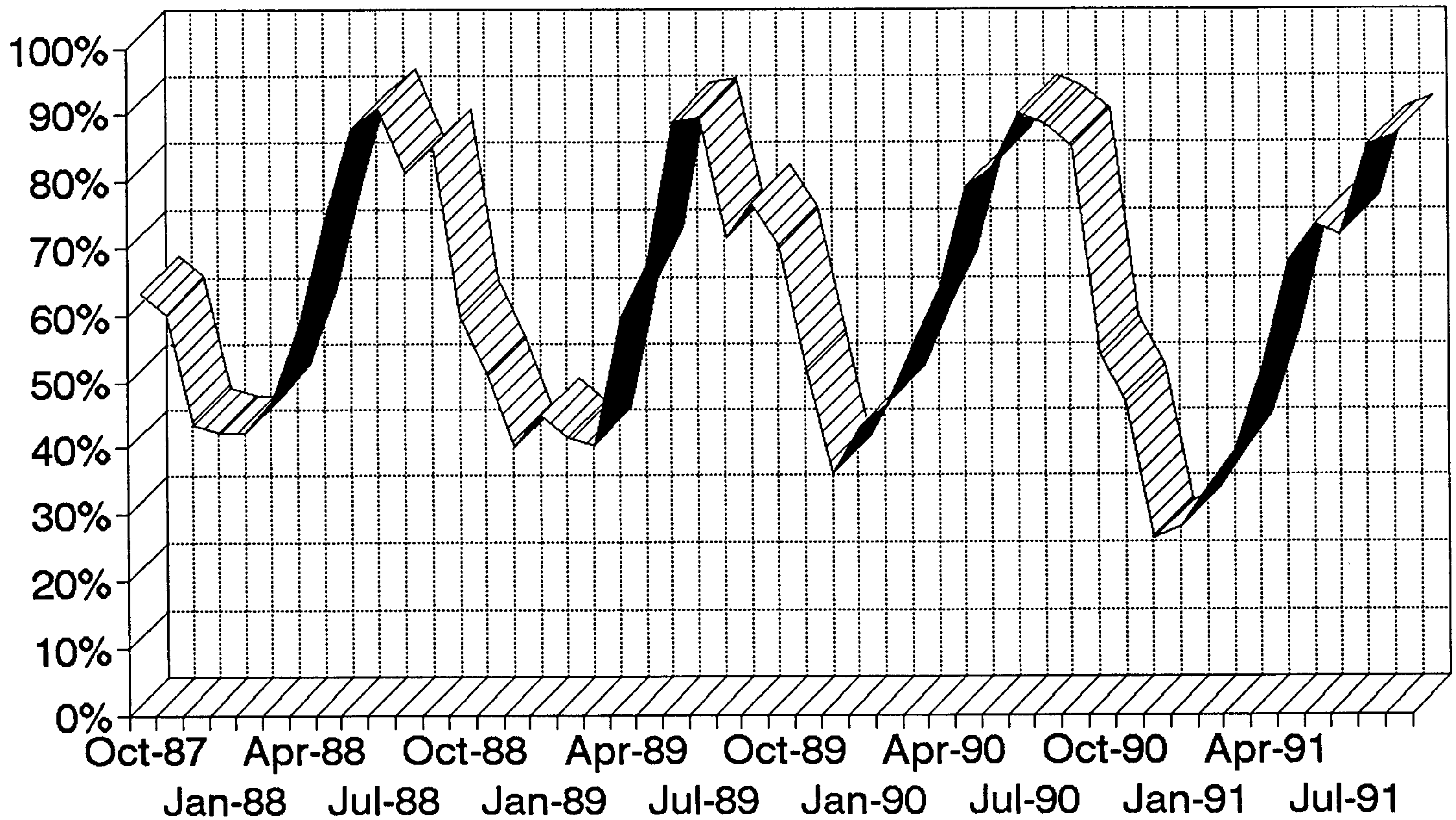


Figure 2-14

Electricity costs dominate the total annual energy bill because of the higher unit price. In FY 90, electricity costs represented over 61 percent of the total expense of $2,895,000 (Figure 2-15).

2.4 Energy and Production Data Analysis

2.4.1 Quantitative Analysis.

Analyses of monthly fuel use over the FY 88-90 period was attempted for both electricity and boiler fuels to determine the quantitative dependence of energy consumption on weather, production, and/or manpower. A statistical linear regression technique was used to determine the dependencies, if any, on the variables mentioned above. The chief measure of a statistical fit of observed data to calculated data is the quantity R^2, where R^2 gives the percentage of observed data that can be attributed to the independent variables.

Variables that were examined for their effect on energy use were weather (heating degree-days and cooling degree-days), labor force, supply manhours, and labor hours (for specific buildings and total LEAD).

2.4.1.1 Boiler Fuels.

As expected, the variation in boiler fuel use is explained by demands for heating during the year. The monthly consumption over the three-year period is best approximated by the equation:

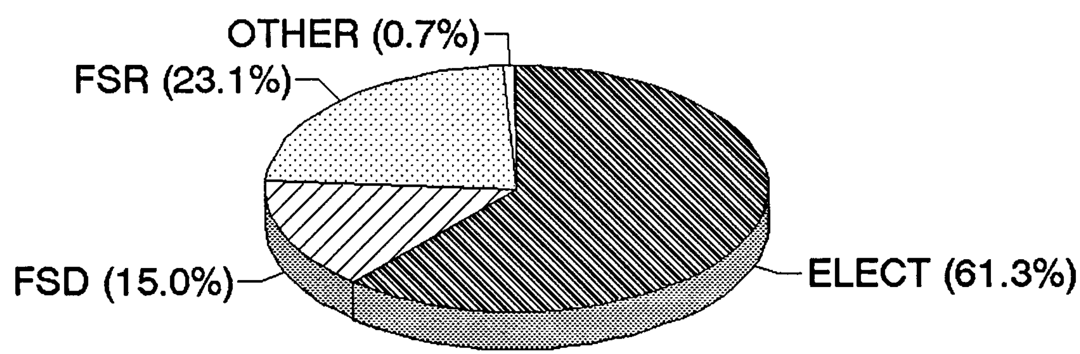
$$\text{MBtu/Month} = 5{,}462 + (44.8)\ \text{HDD}$$

when HDD is the number of heating degree-days during the month, and the number 5,462 represents the average MBtu load on the boilers that is not related to weather (Figure 2-16). The coefficient of HDD states that each heating degree-day requires 44.8 MBtu of heating energy.

Variation in heating degree-days is also shown in Figure 2-16 to illustrate the dependence. The statistical fit of the calculated data to the observed data is quite good, with an R^2 of 93 percent.

Integration of the energy-dependence equation over the 36 months reveals that approximately 80 percent of boiler fuel use is directly related to weather (Figure 2-17).

Letterkenny Army Depot
FY90 Facility Energy Cost



Total Cost = $2,895,000

Figure 2-15

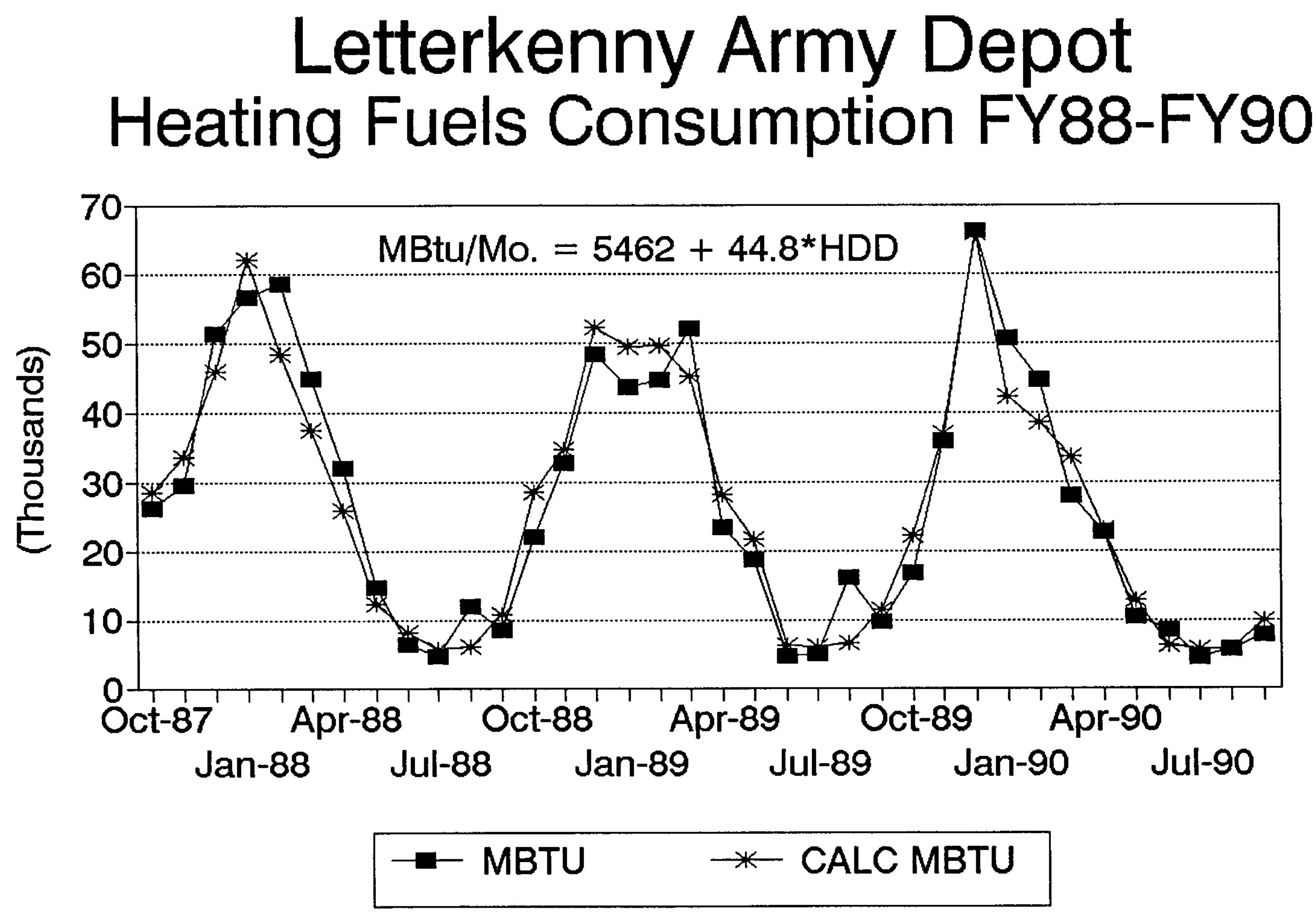

Letterkenny Army Depot
Heating Fuels Consumption FY88-FY90
MBtu/Mo. = 5462 + 44.8*HDD
(Thousands)
0
10
20
30
40
50
60
70
Oct-87
Jan-88
Apr-88
Jul-88
Oct-88
Jan-89
Apr-89
Jul-89
Oct-89
Jan-90
Apr-90
Jul-90
MBTU
CALC MBTU

Figure 2-16

Letterkenny Army Depot
Htg Fuels Use Dependencies FY88-FY90

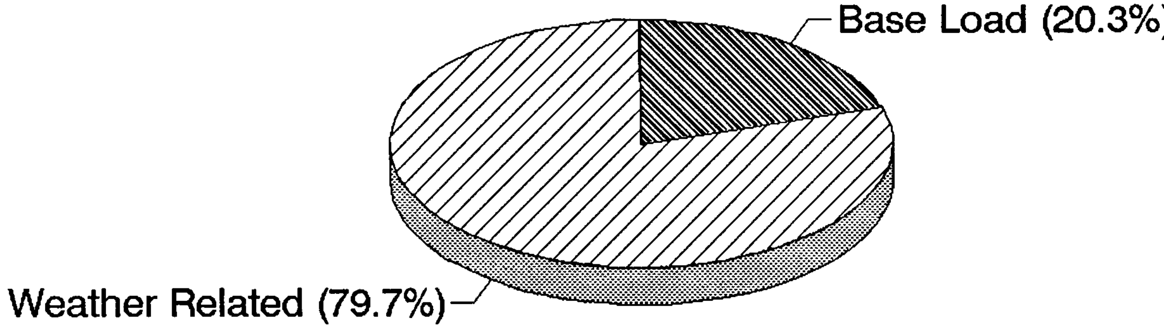


Figure 2-17

2.4.1.1.1 Fiscal Year 1991 Performance. Examination of boiler fuels consumption through the first ten months of fiscal year 1991 (Oct 90 through Jul 91) has been consistent with amounts predicted through regression analysis of the FY 88-90 data. The energy consumption equation for boiler fuels is:

$$\text{MBtu} = 5462 + 44.8 * \text{HDD}$$

where

MBtu = monthly consumption in million Btus

HDD = monthly heating degree-days.

Figure 2-17A shows the comparison of actual and calculated consumption, based on the above equation, extended through July 1991. The table below shows the actual and predicted consumption for FY 91.

1991 Month	Actual MBtu Consumption	Calc. MBtu Consumption
Oct	19,408	18,280
Nov	25,086	31,299
Dec	55,914	46,022
Jan	54,435	54,448
Feb	48,219	40,218
Mar	33,277	36,297
Apr	19,887	22,067
May	9,953	8,666
Jun	8,326	6,179
Jul	9,640	5,462
Total	284,145	268,938

Figure 2-17B shows the cumulative difference per month between the actual and the calculated fuel use for the four fiscal years. It is seen from the above table and the Figure that actual fuel consumption is higher than predicted, particularly in the summer months, but the differences are not statistically significant.

Letterkenny Army Depot

Heating Fuels Consumption FY88-FY91

MBtu/Mo = 5462 + 44.8*HDD

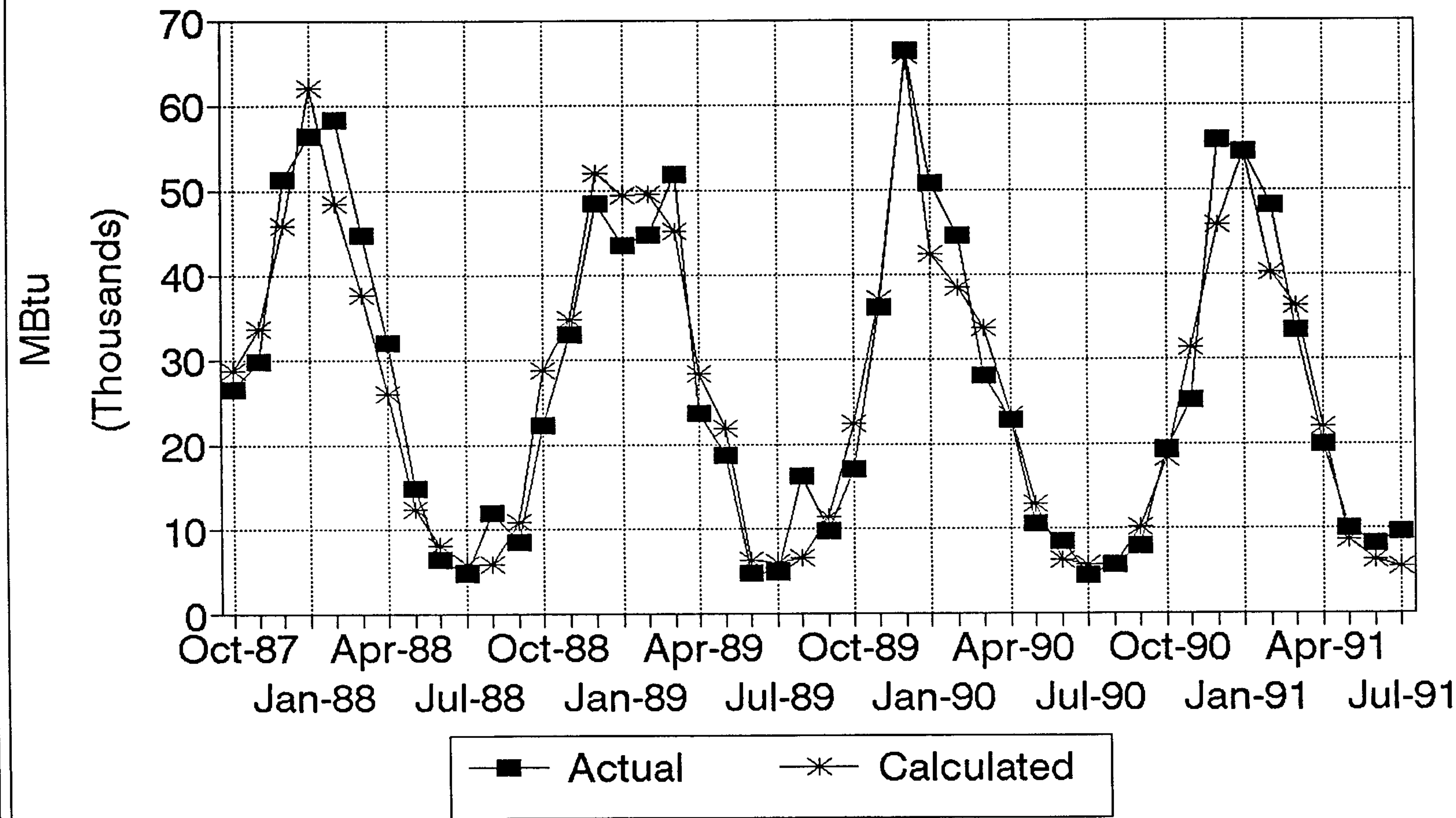
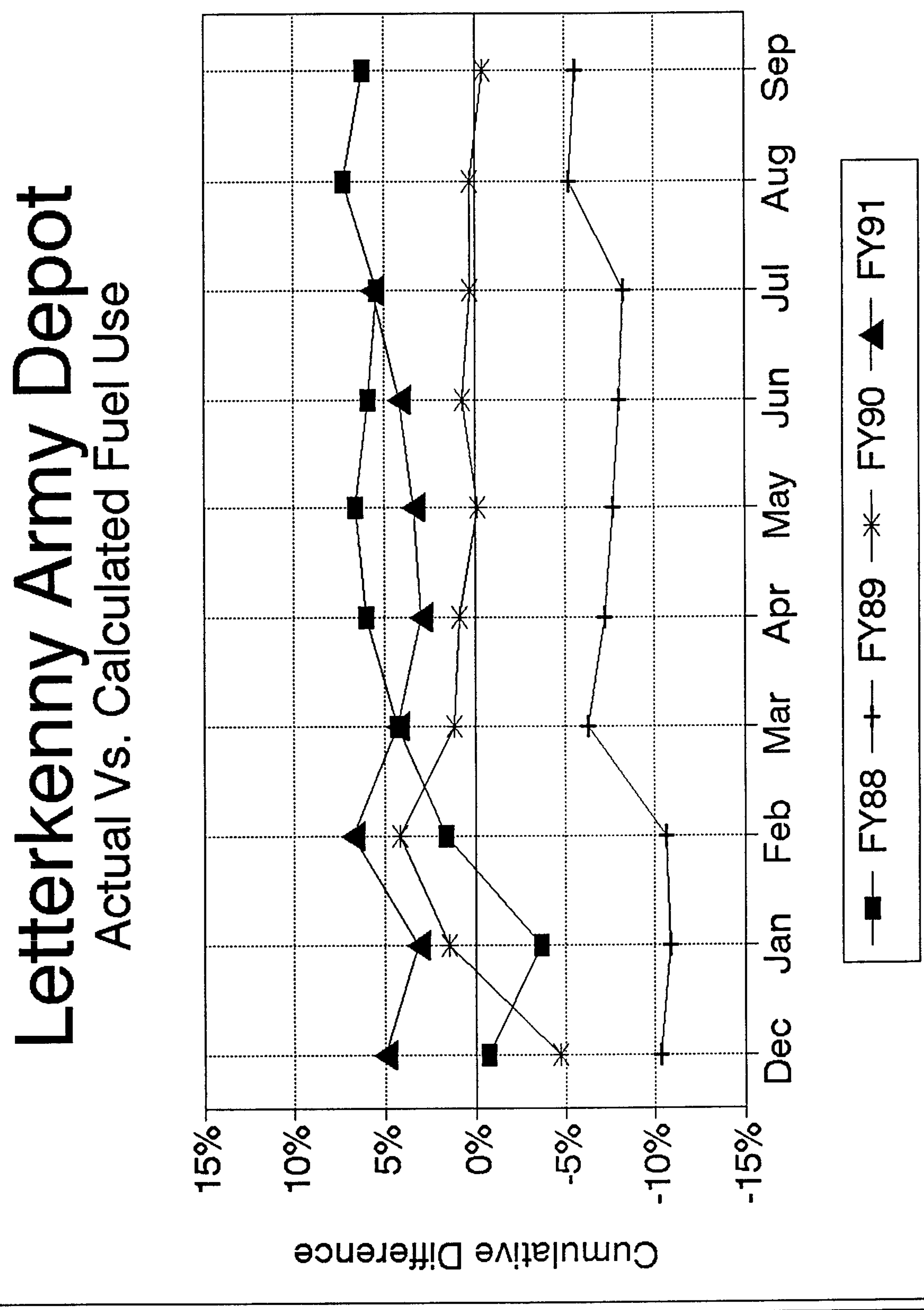


Figure 2-17A



Letterkenny Army Depot
Actual Vs. Calculated Fuel Use
Cumulative Difference
15%
10%
5%
0%
-5%
-10%
-15%
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
FY88
FY89
FY90
FY91

Figure 2-17B

The consumption of boiler fuels during the first ten months of FY 91 has shown no statistically significant differences from the three previous fiscal years. While changes in production schedules may be expected to cause changes in fuel consumption, it may not be possible to quantify the effect. The very high percentage of boiler fuel used because of weather (approximately 80 percent per year) statistically overrides any slight deviations in use due to other causes.

2.4.1.2 Electricity. The dependence of electricity consumption on individual and combinations of variables noted above was examined. There was no statistically significant correlation of electricity use with any of the variables.

2.4.2 Energy Use Distribution

2.4.2.1 Boiler Fuels. LEAD has 19 boilers rated in excess of 3.5 MBtu, and a large number (~64) of ones less than 3.5 MBtu. Examination of the boiler locations and service areas, plus fuel delivery logs, allowed an approximate distribution between end users, shown in Table 2-1 and Figure 2-18.

Buildings dedicated primarily to vehicle rebuilding (Buildings 320, 5 and 349) use the bulk of boiler fuels (63 percent). The only other significant users (22 percent) are the general facilities and administrative buildings, which have a large number of smaller boilers, used primarily for heating. Those buildings containing both administrative and processing were estimated as to their relative end use.

2.4.2.2 Electricity. LEAD has 113 electric meters in place, the majority of which are read monthly. However, a significant amount of electricity is used within buildings that are not metered or the meters are not periodically read.

The results are shown in Table 2-1 and Figure 2-19. General facilities and administrative buildings account for almost 40 percent of total electrical

Table 2-1. LEAD Energy Distribution Allocations

FUEL TYPE		GEN. FAC. & ADMIN.	ELECT REBUILD	VEHICLE REBUILD	ENGINE REBUILD	STORE & RETRIEVE	UN-ALLOCATED	TOTAL	DEIS TOTAL
OIL	MBTU	65,887	17,858	189,562	17,864	10,267	941	302,379	302,379
	% MBTU	22%	6%	63%	6%	3%	0%	100%	
ELECT.	MBTU	63,534	23,222	25,089	4,699	1,874	51,513	169,931	169,931
	% MBTU	37%	14%	15%	3%	1%	30%	100%	
TOTAL	MBTU	129,421	41,080	214,651	22,563	12,141	52,454	472,310	472,310
	% MBTU	27%	9%	45%	5%	3%	11%	100%	

Letterkenny Army Depot
Oil Use Distribution

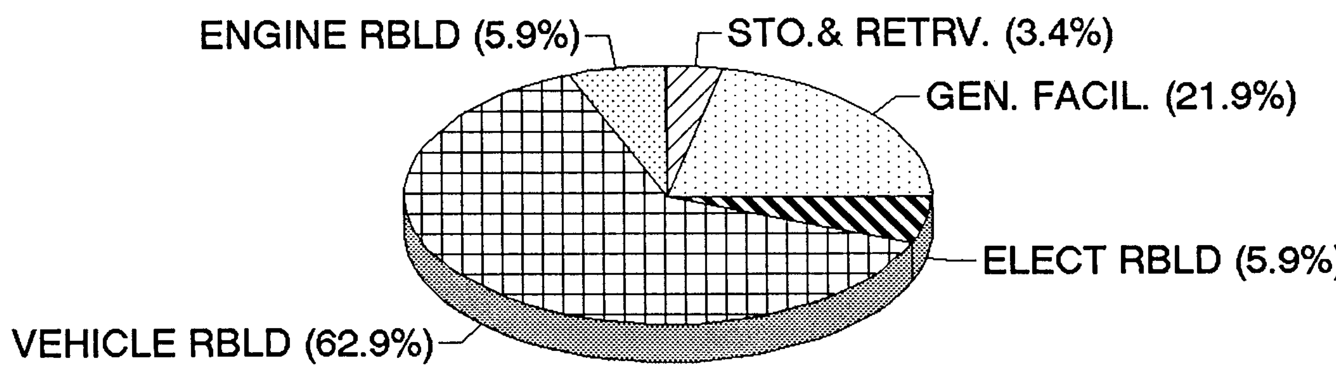


Figure 2-18

Letterkenny Army Depot
Electricity Use Distribution

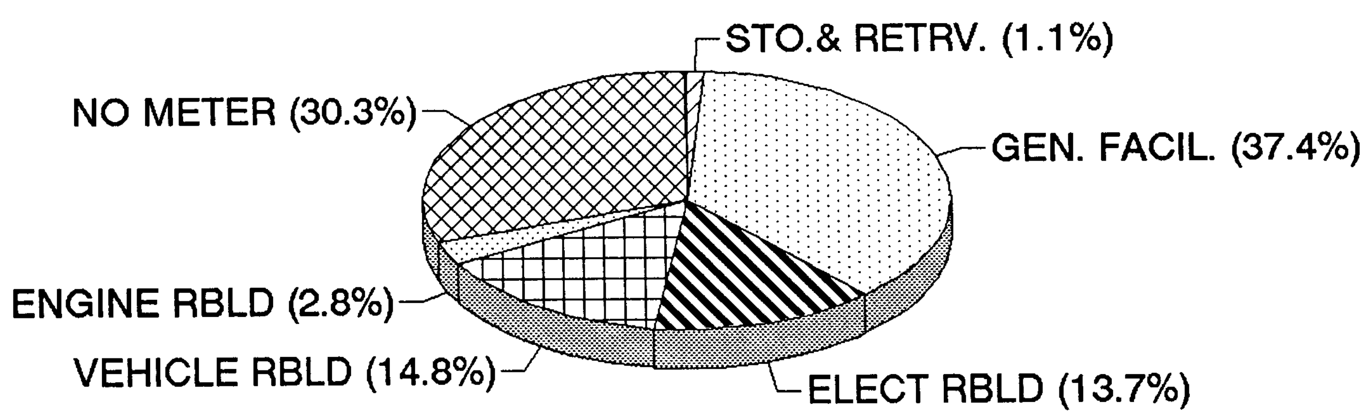


Figure 2-19

use. Both electronics and vehicle rebuild accounts for the majority of the remaining use, where meters allow estimates.

2.4.3 Energy Trends

As noted previously, annual electricity consumption at LEAD did not change significantly during FY 88-90. Since boiler fuel use depends significantly on weather, linear regression analysis was done on the data for each of the three fiscal years, FY 88-90, to see if changes in weather caused the drop in fuel use each year.

Data from all three years showed a significant correlation with heating degree-days (HDD) with respective R^2s of 92.8, 91.9 and 95.8.

Figure 2-20 shows the calculated fuel oil use as a function of HDD for the three separate years. FY 88 and FY 90 show essentially the same dependencies on HDD. FY 89 is notably less, suggesting that some major heating component was not on line that year, or the equipment operated at a higher efficiency.

2.5 Review of Energy Documents

The following documents were reviewed and results incorporated into this report where appropriate.

- Natural Gas Conversion Proposal, People's Gas Co., 11/88
- Energy Engineering Analysis Program, Reynolds, Smith and Hills, Inc., 1982
- Energy Monitoring and Control System Study, Brinjac, Kambic and Associates, Inc., 6/88
- Study of Heat Recovery Applications for Paint and Drying Booths, Brinjac, Kambic and Associates, 8/87

NATURAL GAS CONVERSION PROPOSAL, PEOPLE'S GAS (PNG), 4/89

People's Gas Company proposed to construct a pipeline extension, spurs, measuring stations and pressure-reducing equipment for a total cost of $1,825,000. LEAD and PNG would share in the expense; LEAD's share is $1,193,000. Additionally, LEAD would have to convert certain boilers to dual

Letterkenny Army Depot
Oil Use Calculations FY88 - FY90

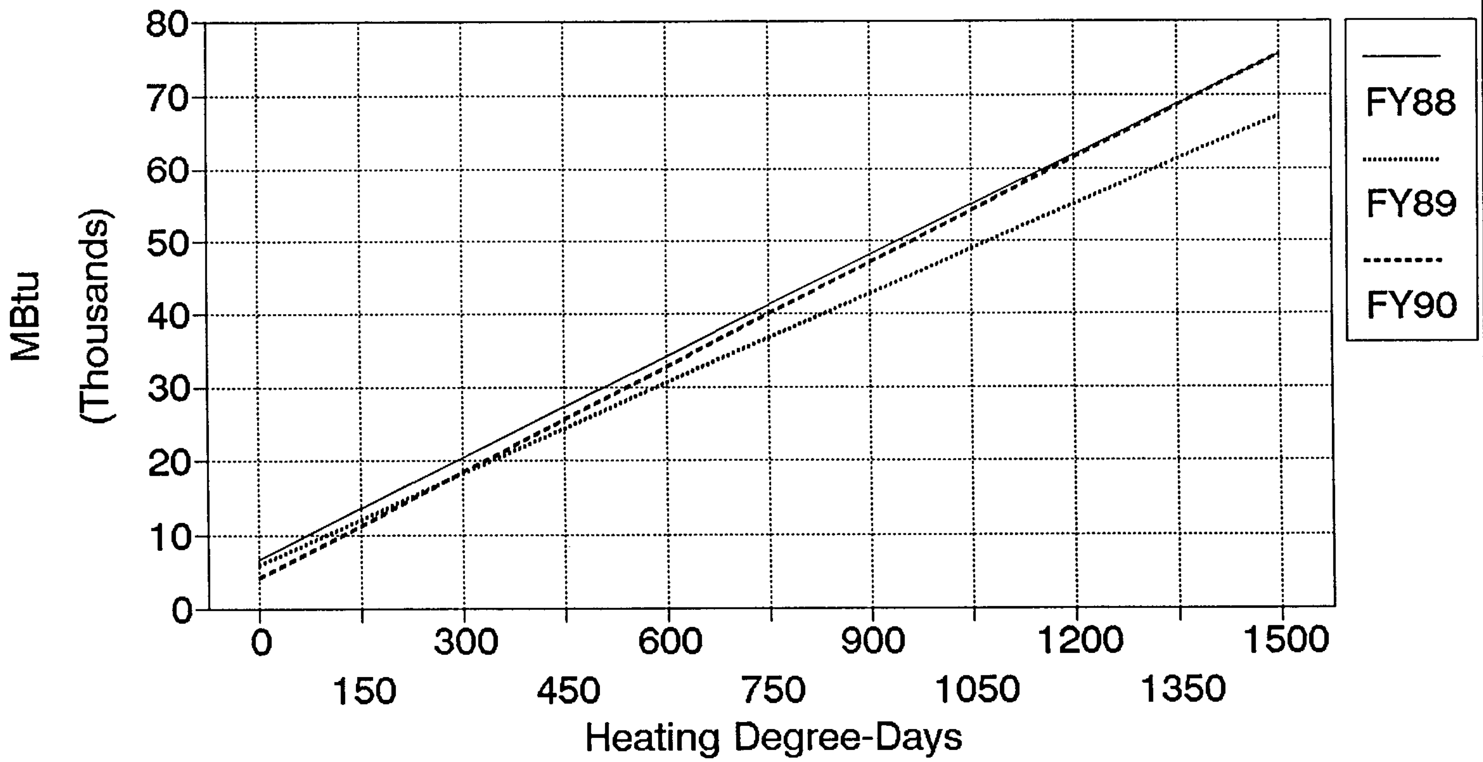


Figure 2-20

fuel at a cost of $384,700, including labor. Assuming a 90-percent utilization of natural gas and a gas price of $4.26 per Mcf or $4.39/Mbtu, the payback is 4.4 years.

Initial Investment:	$1,578,200
Annual Savings:	$358,681
Payback:	4.4 years

Assumptions:

- Boiler Efficiencies:
  - #349: 0.55
  - Natural Gas: 0.80
  - All Others: 0.75
- NG Price $4.39/Mbtu
- Fuel Utilization
  - 90 Percent Natural Gas
  - 10 Percent Fuel Oil
- Fuel Consumption--FY88 Use
- Oil Prices
  - #6: $0.70/gal, 150,000 Btu/gal
  - #5: $0.70/gal, 148,000 Btu/gal
  - #2: $0.82/gal, 139,000 Btu/gal

This project was re-evaluated and the results are included in Section 4.1 of this report as ECO #6.

<u>EEAP, REYNOLDS, SMITH AND HILLS, INC., 1982</u>

The following increments were accomplished by RS&H.

A. Buildings
B. Boiler Plants and Distribution
C. Alternate Energy Sources: Wood and Solar
D. Cogeneration
E. Central Coal-Fired Heating Plants
F. Facility Engineers Projects

G. Non-Qualifying ECIPs from Increments A and B

The following is an index to the LEAD EEAP reports accomplished by Reynolds, Smith and Hills A-E-P, Inc. and copied from the report entitled "Executive Summary," Revision One, 1983.

INDEX TO LEAD EEAP REPORTS

INCREMENTS A AND B--ENERGY CONSERVATION FOR BUILDINGS/PROCESS AND UTILITIES/ DISTRIBUTION/EMCS

- ECIP Project Descriptions 1391s and Back-Up Data--Volume 1--Projects A through E
- ECIP Project Descriptions 1391s and Back-Up Data--Volume 2--Projects F through I
- ECIP Project Descriptions 1391s and Back-Up Data--Volume 3--Projects J through M
- ECIP Project Descriptions 1391s and Back-Up Data--Volume 4--Projects N through R
- PDBs
- Executive Summary--Volume 1
- Main Report--Volume II-A
- Interim Report

INCREMENTS C AND D--RENEWABLE ENERGY AND COGENERATION PROJECTS

- Preliminary Investigation

INCREMENT E--CENTRAL BOILER PLANT PROJECTS

- Feasibility Study Central Coal-Fired Heating Plants
- Feasibility Study Central Coal-Fired Heating Plants--Appendix

INCREMENT F--FACILITIES ENGINEER CONSERVATION MEASURES

- Main Report, Project Descriptions and Back-Up Data--Volume 1
- Main Report, Project Descriptions and Back-Up Data--Volume 2

INCREMENT G--NON-QUALIFYING ECIP PROJECTS

- Energy Conservation Project Descriptions Programming Documents and Back-Up Data--Volume 1--Projects G-A through G-D
- Energy Conservation Project Descriptions Programming Documents and Back-Up Data--Volume 2--Projects G-E through G-J
- Energy Conservation Project Descriptions Programming Documents and Back-Up Data--Volume 3--Projects G-I through G-V

Increment A, Buildings and Increment B, Boiler Plants and Distribution

Eighteen projects were evaluated with eight meeting ECIP criteria for E/C, B/C and payback.

Project	Cost (1981)	Payback (yrs.)
B. Air-to-Chilled Water Precooler Buildings 3 and 10	$124,357	3.3
C. Replace Incandescents with HPS Building 350	237,464	2.6
D. Exhaust Heat Recovery Buildings 350 and 37	153,041	4.6
E. Vapor Barrier for Dehum. Warehouses	806,347	20.9
F. Exhaust Heat Recovery, Chrome Plating, Building 1	126,408	7.0
G. Exhaust Heat Recovery, Dip Tank, Building 350	221,737	8.2
H. Baghouse Insulation	133,686	10.0
I. Exhaust Heat Recovery Paint Booths, Building 350	124,593	10.1

Increment C, Alternate Energy Sources: Wood and Solar

Wood-Fired Steam Facility. A wood-fired boiler was evaluated to replace the oil-fired one in Building 349. The plant cost was estimated to be $3,494,437, but would provide an energy savings due to the low price of wood. The estimated payback was 11.6 years.

Solar Facility. A preliminary assessment study was performed utilizing solar energy for process steam at Building 349 and domestic hot water (DHW) for Buildings 600-608, Kenny Gardens, a family housing area. An analysis was done on a cost-per-square-foot basis. Parabolic reflectors were required for steam generation and flat-plate types for the DHW. The results are shown below.

	Cost ($/sf)	Payback (yrs.)
Parabolic	$119.00	52.6
Flat Plate	63.00	20.3

Increment D, Cogeneration

Three methods of cogeneration were evaluated: diesel engine, (#6 oil), combustion turbine (#6 oil) and steam backpressure turbine (coal). The results are shown below.

	Cost 1980 Dollars	Payback (yrs.)
Diesel Engine	$819,000	No payback
Gas Turbine	912,000	No payback
Steam Turbine	4,049,000	14.4

If natural gas was available, the economics would improve significantly.

Increment E, Central Heating Plant

A central heating plant was evaluated for LEAD which would be fired with coal or coal with supplemental wood or municipal solid waste (MSW). Both conventional and fluidized-bed boilers were examined. The central plant would provide steam to the majority of the LEAD. The results of the Life Cycle Cost Analysis are shown below.

	Cost 1980 Dollars	Life Cycle Cost
Existing System	--	$58,673
Conventional Coal	$8,249,000	34,388
Fluidized Bed	13,569,000	37,400
Conventional Coal and RDF	9,943,000	33,728
Conventional Coal and Wood	9,461,000	33,210

Increment F, Facility Engineers Projects

Increment F projects are those that are less than $100,000 and have SIRs greater than one. Six projects were recommended and are listed below.

Project	Cost 1981 Dollars	Payback (yrs.)
EMCS Modifications	$29,534	0.6
DHW Heat Pumps, Kenny Gardens	4,590	1.6
DHW Tank Insulation	3,445	7.5
Diesel Peaking Unit	99,635	7.5
Temperature Setback, Buildings 2260, 412, 664, 277 and 431	37,104	10.7
Ceiling Insulation	1,620	9.1

Increment G, Non-Qualifying ECIPs from Increments A and B

When the original EEAP was accomplished (1981, 1982 time frame), the requirements for the Energy Conservation Investment Program (ECIP) were the project cost must be greater than $100,000 and energy savings over the life of the project in dollars divided by the project cost (E/C) must be greater than 14. Those projects in Increments A and B that did not meet that criteria were evaluated in Increment G. Twenty Non-Qualifying ECIPs from Increments A and B were evaluated. The results are listed below.

Project	Cost 1981 Dollars	Payback (yrs.)
G-L Motorized Steam Valves, Building 400s	$11,515	0.3
G-M Local Switching, Building 7	5,010	0.6
G-N Warehouse Door Seals Buildings 2 and 4	52,753	1.1
G-A Sawdust Collector Insulation, Building 350	7,300	3.5
G-O Boiler Economizers, Building 349	211,700	4.2
G-B Lighting System Mods. Buildings 19, 37, 47 and 57	30,785	6.5
G-C Lighting Systems Mods. Buildings 1, 2, 4, 5, 8 and 9	$124,388	8.1
G-D Exhaust Heat Recovery, Paint Booth, Building 350	162,211	8.1
G-E Exhaust Heat Recovery, Paint Booth, Building 1	59,142	8.4

G-F Exhaust Heat Recovery, Paint Booth, Building 14	54,869	10.0
G-G Exhaust Heat Recovery, Paint Booth, Buildings 37 and 468	54,869	10.1
G-P Strip Door Curtains, Buildings 2 and 4	32,806	10.2
G-Q Storm Windows, Building 521	20,222	8.4
G-R Storm Windows, Building 663	31,118	10.7
G-H Storm Windows, Building 400s	119,592	11.0
G-S Storm Windows, Building 500	88,305	11.5
G-T Storm Windows, Buildings 4 and 2	19,713	11.9
G-U Storm Windows, Building 3	33,855	11.9
G-V Warehouse Dock Seals, Building 2	44,822	12.0

ENERGY MONITORING AND CONTROL SYSTEM STUDY
BRINJAC, KAMBIC AND ASSOCIATES, INC., 6/88

PHASE I--FACILITY SURVEY

Thirty-six buildings were surveyed to determine the operating condition of the major HVAC equipment and systems. Deficiencies were reported with a suggested corrective action and estimated cost for the correction.

Energy monitoring was found to be minimal. About one-fourth of the buildings surveyed have newer electric meters whose metered areas are known. Loads measured by the older meters scattered throughout the installation are unknown. Fuel oil deliveries are monitored and logged for each boiler. However, one boiler usually serves more than one building. No other energy meters exist.

The most significant HVAC system deficiencies found were those due to building renovations and changes in building use. Other than the air distribution problems and a controls problem with the Building 6 VAV unit, the deficiencies are readily correctable.

PHASE II--EMCS EVALUATION

EMCSs were recommended in 22 of the 36 buildings evaluated. Both central and individual building EMCSs were studied. The recommended system was a medium-sized, central EMCS with 484 points. The results of the study are listed below.

EMCS Type	Cost 1988 Dollars	Payback (yrs.)
Central	$699,092	3.1
Individual	329,047	1.5

An individual EMCS project was re-evaluated in this report for Building 370. The results are located in Section 4.1, ECO #5.

STUDY OF HEAT RECOVERY APPLICATIONS FOR PAINT AND DRYING BOOTHS

BRINJAC, KAMBIC AND ASSOCIATES, INC., 8/87

Forty-nine booths were identified and studied. The study looked in detail at maintenance, cleaning, filtration, heat recovery, make-up air systems, design deficiencies and energy recovery methods. Heat recovery techniques did not show attractive paybacks. A strong recommendation was made for make-up air units for the booths, although no savings were calculated. Good paybacks were found for installing backdraft dampers in the paint booth exhaust air ducts and replacing manual dampers with self-closing types.

3.0 <u>METHODOLOGY</u>

3.1 Site Survey

Letterkenny Army Depot is a large industrial complex covering over 20,000 acres and containing about 980 buildings. As discussed in Section 2.0, LEAD maintains a wide variety of combat vehicles and equipment. The intent of this effort is to survey those buildings that contain the more energy-intensive processes. A list of those areas and buildings are contained in Annex D of the Scope of Work (Appendix A).

The emphasis for this study is to concentrate on energy savings in the industrial processes. A previous EEAP was performed that identified projects in the building envelope, space heating systems, etc. This type of information was not gathered here unless the building is conditioned because of specific <u>process</u> requirements. The site survey was conducted February 25 to March 1, 1991. Survey sheets for each of the buildings visited plus personnel interview forms are contained in Volume III.

3.2 Energy Analysis

3.2.1 Linear Regression. The linear regression analysis was performed using a software package called Spreadsheet Regression (SSR), developed by Background Development Company of Tallahassee, Florida. SSR is a spreadsheet add-on program that can be run on most IBM® compatible personal computers. It is a complete multiple regression package, designed to operate entirely within a Lotus 1-2-3® spreadsheet.

3.2.2 ECOs. Energy savings for ECOs were calculated using standard methods documented in a variety of engineering texts including the ASHRAE Handbooks. Cost estimates were developed using 1991 Means Cost Data or through equipment vendors' quotes.

3.2.3 Economics. Economic evaluations were performed using Version 1.0, Level 62 of the Life Cycle Cost in Design (LCCID) computer program available from the BLAST Support Office, Department of Mechanical and Industrial Engineering, University of Illinois at Urbana-Champaign. LCCID calculates life cycle costs, simple payback and SIR for use in evaluating energy conservation opportunities in DOD construction.

All analyses performed before October 1, 1991 (including the Interim Submittal) used FY 91 fuel oil prices, which are about 40 percent more than FY 92 values. All ECOs, except for those that were non-qualifying under the FY 91 prices, were recalculated using FY 92 rates. The complete list of prices are in Appendix B.

4.0 ENERGY ANALYSIS

4.1 Energy Conservation Opportunity (ECO) Evaluations

Each of the ECOs listed in the Scope of Work plus others were reviewed for their applicability and potential for significant energy savings and cost effectiveness for buildings representative of high energy consumption process areas at LEAD. The buildings actually surveyed vary slightly from the list in the scope of work, but the intent of the survey was accomplished--to survey and investigate energy savings in the major energy users in all active production areas. The results of this assessment are contained in tables in Appendix B.

For each of the ECOs that were chosen to be evaluated, energy savings were calculated, cost estimates made and Life Cycle Cost Analyses performed. A summary of the results are contained in Tables 4-1 and 4-2. The evaluated ECOs are described and listed in Table 4-1. An alphabetical listing of evaluated ECOs along with a summary of the energy and cost savings analysis is shown in Table 4-2. Table 4-3 contains a listing prioritized by SIR. Table 4-4 contains a list prioritized by simple payback. Backup data and calculations are contained in Appendix B.

The ECO numbers are of the form ECO # or ECO X-UP where # represents a number and X represents a letter. The ECOs with letters designate an ECO that is being updated from a previous EEAP Study. The sequentially numbered ECOs are new ones.

Table 4-1. ECOs Evaluated - Titles

No	ECO #	Description
1	1	Compressed air valve replacement in Building 350
2	2	Change "Steam" clean heating method in Bldgs. 349 & 351
3	3	Dip tank covers in Buildings 1, 37, 350 & 370
4	4	Heat recovery from paint booth exhaust air
5	5	EMCS in Building 370
6	6	Heat recovery from condensate in Building 349
7	7	No. 6 fuel oil recirculation control in Building 349
8	8	Reflectors for fluorescent fixtures in Buildings 5 & 370
9	9	Paint booth fan controls
10	10	Paint booth air flow control in Buildings 320 & 350
11	11	Blast booth fan cut off in Buildings 37 & 350
12	12	Boiler conversion to #5 fuel oil in Bldgs. 2, 8, 37 & 320
13	13	Energy efficient fluorescent lamps in Building 370
14	14	Energy efficient frequency converters in Building 370
15	15	Modular offices in Buildings 6-South, 8 & 9
16	16	Boiler conversion to natural gas in ten buildings
17	D-UP	Heat recovery from paint booths and engine test cells
18	E-UP	Vapor barrier for dehumidified warehouses
19	G-UP	Dip tank exhaust heat recovery in Building 350-North
20	H-UP	Baghouse insulation & exhaust air return in Bldgs. 37 & 35
21	I-UP	Large paint booth exhaust heat recovery in Building 350
22	J-UP	Medium paint booth exhaust heat recovery in Building 350
23	N-UP	Window & wall insulation in Bldgs. 422, 424, 426, 433 & 43
24	R-UP	High pressure sodium lighting in Bldgs. 31 - 34 & 41 - 44
25	G-E-UP	Paint booth exhaust heat recovery in Building 1
26	G-F-UP	Paint booth exhaust heat recovery in Building 14
27	G-G-UP	Paint booth exhaust heat recovery in Building 37
28	G-I-UP	Dip tank exhaust heat recovery in Building 350-South
29	G-J-UP	Main steam system expansion to Building 320
30	G-N-UP	Warehouse door seals in Buildings 2 and 4
31	G-P-UP	Strip curtains for warehouse doors in Building 2 and 4
32	G-U-UP	Storm windows in Building 3
33	G-V-UP	Loading dock door seals for Building 2

Table 4-2. ECO Evaluations - Results

No.	ECO #	Construction Cost Plus SIOH	Savings (Increase), MBtu/Year Elec	Dist	Resid	N Gas	Net Cost Savings	SIR	Simple Payback (Years)
1	1	$7,671	366	-	-	-	$4,004	7.5	2.0
2	2	$15,985	-	-	-	-	-	-	-
3	3	$198,942	2,496	-	26,034	-	$137,400	10.0	1.5
4	4	-	-	-	-	-	-	-	-
5	5	$172,629	2,640	-	6,536	-	$57,700	4.3	3.2
6	6	$2,557	-	-	938	-	$4,100	38.6	0.7
7	7	-	-	-	-	-	-	-	-
8	8	$33,778	613	-	-	-	$6,711	2.8	5.3
9	9	$4,858	124	-	4,895	-	$22,900	71.0	0.2
10	10	$224,367	1,503	5,674	4,397	-	$64,100	3.8	3.7
11	11	$6,888	1,610	-	-	-	$17,613	26.0	0.4
12	12	$94,587	-	32,504	(32,504)	-	$26,653	-2.7	3.8
13	13	$19,400	153	-	-	-	$1,677	1.2	12.2
14	14	$147,457	567	-	-	-	$6,203	0.6	25.1
15	15	$24,637	(20)	2,775	-	-	$13,600	11.2	1.9
16	16	$2,415,158	-	36,513	226,569	(263,082)	$160,200	3.1	15.9
17	D-UP	$310,602	(750)	425	2,249	-	$9,819	1.0	33.4
18	E-UP	$799,693	5,937	-	-	-	$49,791	0.9	17.0
19	G-UP	$225,142	(107)	-	6,453	-	$27,300	2.9	8.7
20	H-UP	$132,659	-	-	2,988	-	$13,200	2.4	10.6
21	I-UP	$382,805	(1,111)	-	3,703	-	$12,322	1.1	32.8
22	J-UP	$382,804	(1,010)	-	3,644	-	$13,037	1.1	31.0
23	N-UP	$122,307	-	-	2,749	-	$13,700	2.3	9.4
24	R-UP	$287,199	465	-	-	-	$5,087	0.3	59.7
25	G-E-UP	$115,821	(141)	-	510	-	$1,829	0.5	67.0
26	G-F-UP	$93,779	(90)	-	325	-	$1,164	0.4	85.2
27	G-G-UP	$115,821	(109)	-	393	-	$1,405	0.4	87.1
28	G-I-UP	$40,123	(78)	-	338	-	$1,381	1.0	30.7
29	G-J-UP	$1,065,732	-	8,780	8,780	-	$7,200	0.0	147.4
30	G-N-UP	$51,320	-	900	1,982	-	$6,300	4.0	8.6
31	G-P-UP	$31,981	-	598	508	-	$611	2.2	55.3
32	G-U-UP	$29,144	-	-	255	-	$1,176	1.0	26.2
33	G-V-UP	$27,282	-	-	345	-	$1,500	1.3	19.0

Table 4-3. ECO Evaluations - Results Prioritized by SIR

No.	ECO #	Construction Cost Plus SIOH	Savings (Increase), MBtu/Year Elec	Dist	Resid	N Gas	Net Cost Savings	SIR	Simple Payback (Years)
1	9	$4,858	124	-	4,895	-	$22,900	71.0	0.2
2	6	$2,557	-	-	938	-	$4,100	38.6	0.7
3	11	$6,888	1,610	-	-	-	$17,613	26.0	0.4
4	15	$24,637	(20)	2,775	-	-	$13,600	11.2	1.9
5	3	$198,942	2,496	-	26,034	-	$137,400	10.0	1.5
6	1	$7,671	366	-	-	-	$4,004	7.5	2.0
7	5	$172,629	2,640	-	6,536	-	$57,700	4.3	3.2
8	G-N-UP	$51,320	-	900	1,982	-	$6,300	4.0	8.6
9	10	$224,367	1,503	5,674	4,397	-	$64,100	3.8	3.7
10	16	$2,415,158	-	36,513	226,569	(263,082)	$160,200	3.1	15.9
11	G-UP	$225,142	(107)	-	6,453	-	$27,300	2.9	8.7
12	8	$33,778	613	-	-	-	$6,711	2.8	5.3
13	H-UP	$132,659	-	-	2,988	-	$13,200	2.4	10.6
14	N-UP	$122,307	-	-	2,749	-	$13,700	2.3	9.4
15	G-P-UP	$31,981	-	598	508	-	$611	2.2	55.3
16	G-V-UP	$27,282	-	-	345	-	$1,500	1.3	19.0
17	13	$19,400	153	-	-	-	$1,677	1.2	12.2
18	I-UP	$382,805	(1,111)	-	3,703	-	$12,322	1.1	32.8
19	J-UP	$382,804	(1,010)	-	3,644	-	$13,037	1.1	31.0
20	D-UP	$310,602	(750)	425	2,249	-	$9,819	1.0	33.4
21	G-I-UP	$40,123	(78)	-	338	-	$1,381	1.0	30.7
22	G-U-UP	$29,144	-	-	255	-	$1,176	1.0	26.2
23	E-UP	$799,693	5,937	-	-	-	$49,791	0.9	17.0
24	14	$147,457	567	-	-	-	$6,203	0.6	25.1
25	G-E-UP	$115,821	(141)	-	510	-	$1,829	0.5	67.0
26	G-F-UP	$93,779	(90)	-	325	-	$1,164	0.4	85.2
27	G-G-UP	$115,821	(109)	-	393	-	$1,405	0.4	87.1
28	R-UP	$287,199	465	-	-	-	$5,087	0.3	59.7
29	G-J-UP	$1,065,732	-	8,780	8,780	-	$7,200	0.0	147.4
30	12	$94,587	-	32,504	(32,504)	-	$26,653	-2.7	3.8
31	2	$15,985	-	-	-	-	-	-	-
32	7	-	-	-	-	-	-	-	-
33	4	-	-	-	-	-	-	-	-

Table 4-4. ECO Evaluations - Results Prioritized by Simple Payback

No.	ECO #	Construction Cost Plus SIOH	Savings (Increase), MBtu/Year				Net Cost Savings	SIR	Simple Payback (Years)
			Elec	Dist	Resid	N Gas			
1	9	$4,858	124	-	4,895	-	$22,900	71.0	0.2
2	11	$6,888	1,610	-	-	-	$17,613	26.0	0.4
3	6	$2,557	-	-	938	-	$4,100	38.6	0.7
4	3	$198,942	2,496	-	26,034	-	$137,400	10.0	1.5
5	15	$24,637	(20)	2,775	-	-	$13,600	11.2	1.9
6	1	$7,671	366	-	-	-	$4,004	7.5	2.0
7	5	$172,629	2,640	-	6,536	-	$57,700	4.3	3.2
8	10	$224,367	1,503	5,674	4,397	-	$64,100	3.8	3.7
9	12	$94,587	-	32,504	(32,504)	-	$26,653	-2.7	3.8
10	8	$33,778	613	-	-	-	$6,711	2.8	5.3
11	G-N-UP	$51,320	-	900	1,982	-	$6,300	4.0	8.6
12	G-UP	$225,142	(107)	-	6,453	-	$27,300	2.9	8.7
13	N-UP	$122,307	-	-	2,749	-	$13,700	2.3	9.4
14	H-UP	$132,659	-	-	2,988	-	$13,200	2.4	10.6
15	13	$19,400	153	-	-	-	$1,677	1.2	12.2
16	16	$2,415,158	-	36,513	226,569	(263,082)	$160,200	3.1	15.9
17	E-UP	$799,693	5,937	-	-	-	$49,791	0.9	17.0
18	G-V-UP	$27,282	-	-	345	-	$1,500	1.3	19.0
19	14	$147,457	567	-	-	-	$6,203	0.6	25.1
20	G-U-UP	$29,144	-	-	255	-	$1,176	1.0	26.2
21	G-I-UP	$40,123	(78)	-	338	-	$1,381	1.0	30.7
22	J-UP	$382,804	(1,010)	-	3,644	-	$13,037	1.1	31.0
23	I-UP	$382,805	(1,111)	-	3,703	-	$12,322	1.1	32.8
24	D-UP	$310,602	(750)	425	2,249	-	$9,819	1.0	33.4
25	G-P-UP	$31,981	-	598	508	-	$611	2.2	55.3
26	R-UP	$287,199	465	-	-	-	$5,087	0.3	59.7
27	G-E-UP	$115,821	(141)	-	510	-	$1,829	0.5	67.0
28	G-F-UP	$93,779	(90)	-	325	-	$1,164	0.4	85.2
29	G-G-UP	$115,821	(109)	-	393	-	$1,405	0.4	87.1
30	G-J-UP	$1,065,732	-	8,780	8,780	-	$7,200	0.0	147.4
31	4	-	-	-	-	-	-	-	-
32	7	-	-	-	-	-	-	-	-
33	2	$15,985	-	-	-	-	-	-	-

ECO Number: 1

COMPRESSED AIR VALVE REPLACEMENT IN BUILDING 350

Discussion

Building 350 is constructed with a one-inch diameter compressed air supply on each of the 228 columns. Typically, these air stations are arranged with a shut-off gate valve followed by one or more quick disconnect compressed air hose fittings. The problem is that many of the air stations are leaking compressed air continuously.

All the leaks are in valve stem packings or hose connections downstream of the manual, gate-type, shut-off valve located on the column. Typically, these valves are left open all the time, allowing the compressed air to leak out. The background noise is too high to hear the leaks, and the workmen often wear gloves so they cannot feel them either. It is cumbersome to shut off a gate valve which requires multiple turns, particularly if access to it is blocked by surrounding equipment. A ball valve shuts off quickly (requiring on a single motion through 90° angle), requires little excess, and is less susceptible to leaking.

Based on the results of a leak survey (see Appendix B), it is estimated that about half of the 228 columns in Building 350, have a detectable leak. These leaks total 85 cfm and cost approximately $4,000 annually.

Recommendations

It is recommended that the compressed air shut-off valve on each column in Building 350 be changed from the existing gate valve to a ball valve; and that this new valve be closed at all times when compressed air is not in use. Typically, this would be at the end of a workman's shift.

Construction Cost	$7,271
Annual Energy Savings (MBtu/yr)	
Electricity	366
Annual Energy Cost Savings ($/yr)	$4,004
SIR	7.5
Simple Payback (years)	2.0

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECO1
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #1 COMPRESSED AIR VALVE REPLACEMENT
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

A. CONSTRUCTION COST	$	7271.
B. SIOH	$	400.
C. DESIGN COST	$	437.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	8108.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	366.	$ 4004.	15.11	60501.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	0.	$ 0.	25.22	0.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		366.	$ 4004.		$ 60501.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 19965.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 4004.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 60501.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 7.46
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 2.02

ECO Number: 2

"STEAM" CLEANING HEAT METHOD MODIFICATION

Discussion

Before vehicles are disassembled, they are cleaned with a high-pressure, hot water/detergent mixture. The facility personnel call it "steam" cleaning because live steam is used to heat and pressurize the water before it exits the cleaning wand nozzle at 180°F.

Substantial energy and operating cost savings can result by changing the heating method in Building 351. This ECO recommends that the heating method be changed using a steam-fed heat exchanger and a pump to provide the needed pressure. The steam pressure used to heat the water can then be lowered from 100 psig currently used to 15 psig.

Originally, the idea was to lower the boiler pressure from 100 psig to 15 psig. By doing this, manpower savings would be realized due to reduced safety requirements for a low pressure boilers and the boilers could be shut down on weekends. However, Keeler Boiler representatives discouraged reducing the boiler pressure below 50 psig. Also, LEAD has begun shutting down Building 349 boilers on the weekends during the summer of 1991.

If a pressure-reducing valve was installed at the boiler plant to achieve the reduced pressure, there would be savings due to reduced steam flow through leaky lines and reduced conduction losses through steam distribution lines. However, steam leaks are very difficult to quantify and should be fixed regardless of the pressure. Also, decreased conduction losses for underground insulated steam lines will be minimal.

Recommendations

Because the operating pressure of the boilers cannot be reduced to 15 psig, the manpower savings due to reduced safety requirements for lower pressure boilers cannot be realized. The remainder of the savings calculated earlier were due to shutting the boiler down on weekends because of the reduced expansion/contraction for a lower pressure boiler. LEAD began this practice with the 100 psig boilers during the summer of 1991. Savings due to reduced

flow through leaky steam traps and reduced convection losses from steam distribution lines are small. Therefore, this project is not recommended.

Construction Cost	$15,151
Annual Energy Savings (MBtu/yr)	
No. 6 Fuel Oil	Negligible
Annual Energy Cost Savings ($/yr)	-
SIR	-
Simple Payback (years)	-

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ECO Number: 3

DIP TANK COVERS WITH EXHAUST FAN CONTROLS

Discussion

Noxious dip tank fumes are exhausted in accordance with OSHA guidelines to protect workers. Ventilation of the fumes is accomplished by drawing room air across the surface of the dip tank fluid, into an exhaust duct, through a ventilation fan and out through the roof to the atmosphere. The warm room air used to entrain the fumes must be replaced with outside air that must be heated. The exhausted air represents a significant heat loss.

The amount of exhausted air can be minimized by covering the dip tank and draft slot with a flexible, chemically resistant cover whenever the tank is not in use. With the cover in place, the fume evolution potential is sharply reduced, so the amount of exhaust air can also be reduced. The reduction in exhaust air represents substantial energy savings from both reduced warm air loss as well as from reduced exhaust fan power.

This ECO provides all vented dip tanks with a flexible, chemically resistant cover (like a tarpaulin) permanently fixed to each tank/vent-duct assembly. The cover can be extended or retracted by appropriate means ranging from manually rolling and unrolling to spring-assisted retraction, similar to the operation of a window shade (see Volume II for sketches). This ECO also provides for exhaust fan speed reduction whenever the covers are in place. The speed reduction will be accomplished by measuring and controlling a set pressure rise across the exhaust fan with a differential pressure sensor and controller which in turn will adjust the speed of the exhaust fan motor through a variable frequency drive. This fan speed control will be particularly effective in Buildings 1 and 370 where fans serve multiple tanks. With this control technique, the OSHA-mandated exhaust air flows can be maintained under all conditions of variable building pressure and variable tank use.

This approach to dip tank operation has been discussed with OSHA in Harrisburg, Pennsylvania, and determined to be acceptable.

Recommendation

Based on the Life Cycle Cost Analysis and a discussion with OSHA, it is recommended that flexible, chemically resistant dip tank covers be installed along with vent fan pressure differential controllers on the 29 vented dip tanks as noted in the Appendix.

Construction Cost	$188,590
Annual Energy Savings (MBtu/yr)	
Nos. 5 & 6 Oil	26,034
Electricity	2,496
Annual Energy Cost Savings ($/yr)	$142,100
Additional Maintenance	$4,700
SIR	10.0
Simple Payback (years)	1.5

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECO3
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #3 DIP TANK COVERS
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-21-91 ECONOMIC LIFE 15 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	188570.
B. SIOH	$	10372.
C. DESIGN COST	$	11315.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	210257.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	2496.	$ 27306.	10.75	293542.
B. DIST	$ 4.98	0.	$ 0.	14.08	0.
C. RESID	$ 4.41	26034.	$ 114810.	16.21	1861069.
D. NAT G	$ .00	0.	$ 0.	13.25	0.
E. COAL	$ .00	0.	$ 0.	11.13	0.
F. TOTAL		28530.	$ 142116.		$ 2154611.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ -4700.
(1) DISCOUNT FACTOR (TABLE A) 10.59
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ -49773.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ -49773.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 711022.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 137416.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 2104838.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 10.01
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 1.53

ECO Number: 4

EXHAUST AIR HEAT RECOVERY AT PAINT SPRAY BOOTHS

Discussion

This ECO is on the list of specific ECOs in Annex D of the Scope of Work LEAD personnel had recommended for study. Exhaust air heat recovery from paint booths has been evaluated both in the "EEAP" by RS&H and "Study of Heat Recovery Applications for Paint and Drying Booths" by BK&A. Projects from the previous "EEAP" which dealt with this ECO were updated using information from both reports. The recovery of heat from paint booth exhaust is addressed in the following ECOs:

ECO # I-UP
ECO # J-UP
ECO # G-D-UP
ECO # G-E-UP
ECO # G-F-UP
ECO # G-G-UP

ECO Number: 5

EMCS IN BUILDING 370

Discussion

A thorough EMCS study was completed in 1989 by Brinjac, Kambic and Associates (BK&A). The results of this study showed a good potential for energy savings by installing an EMCS in Building 370. The four energy savings programs that showed acceptable paybacks were scheduled start/stop, day/night temperature setback, modified economizer and reheat coil reset. The modified economizer program saves cooling energy (electricity) only, while the other three programs save both heating (fuel oil) and cooling energy.

This ECO updates the calculations and cost estimates of the BK&A report. The energy costs were recalculated to reflect current prices and the cost estimates were escalated based on the ENR Construction Cost Index. The results of this analysis are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this ECO is recommended.

	1989 Estimate	1991 Estimate
Construction Cost	$100,997	$163,629
Annual Energy Savings (MBtu/yr)		
No. 6 Fuel Oil	6,536	6,536
Electricity	2,640	2,640
Annual Energy Cost Savings ($/yr.)	$76,286	$57,700
SIR	--	4.3
Simple Payback (years)	1.3	3.2

LIFE CYCLE COST ANALYSIS SUMMARY   STUDY: ECO5
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)   LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #5 EMCS IN BUILDING 370
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 15 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	163629.
B. SIOH	$	9000.
C. DESIGN COST	$	9818.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	182447.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	2640.	$ 28882.	10.75	310477.
B. DIST	$ 4.98	0.	$ 0.	14.08	0.
C. RESID	$ 4.41	6536.	$ 28824.	16.21	467233.
D. NAT G	$ .00	0.	$ 0.	13.25	0.
E. COAL	$ .00	0.	$ 0.	11.13	0.
F. TOTAL		9176.	$ 57705.		$ 777710.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A)   10.59
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 256644.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 57705.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 777710.

6. DISCOUNTED SAVINGS RATIO   (SIR)=(5 / 1F)=   4.26
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED)   SPB=1F/4   3.16

ECO Number: 6

CONDENSATE HEAT RECOVERY FOR BOILERS IN BUILDING 349

Discussion

This ECO identifies known steam and condensate losses, assesses their recoverability and evaluates their economic impact.

Steam losses for deaerator heating, atomizing steam, soot blowing and steam cleaning are all vented directly or indirectly to the atmosphere. Condensate losses from dip tank heating may be contaminated by chemicals used in various processes and water losses from boiler blowdown are "dirty" and unsuitable for return. One energy savings option is to recover the heat from the various streams.

The heat in the boiler blowdown can be recovered for boiler makeup. The heat in the dip tank condensate can be used to heat building air during the heating season. Both of these options are evaluated in this ECO.

Recommendations

Based on the Life Cycle Cost Analysis, heat recovery from the boiler blowdown is not recommended. However, heat recovery from dip tank condensate in Buildings 350N, 350S and 370 are recommended.

Construction Cost	$2,423
Annual Energy Savings (MBtu/yr)	
No. 6 Fuel Oil	938
Annual Energy Cost Savings ($/yr)	$4,100
SIR	38.6
Simple Payback (years)	0.7

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECO6
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #6 HEAT RECOVERY FROM CONDENSATE
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

A. CONSTRUCTION COST	$	2423.
B. SIOH	$	134.
C. DESIGN COST	$	146.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	2703.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 4.98	0.	$ 0.	21.31	0.
C. RESID	$ 4.41	938.	$ 4137.	25.22	104325.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		938.	$ 4137.		$ 104325.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 34427.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 4137.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 104325.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 38.60
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 .65

ECO Number: 7

NUMBER 6 FUEL OIL RECIRCULATION CONTROL ADJUSTMENT IN BUILDING 349

Discussion

This ECO arose as a result of an oil storage tank overheating problem reported by Building 349 operating personnel. An investigation revealed this problem could be cured with a simple adjustment requiring no capital cost. Therefore, this matter is discussed further in the O&M section.

ECO Number: 8

FLUORESCENT FIXTURE REFLECTORS IN BUILDING 370

Discussion

The casing repair area has approximately 450 pendant-mounted, fluorescent light fixtures. Each one of these fixtures has four 40-watt lamps. Task lights are used in addition to these overhead lights. By utilizing reflectors and removing one ballast and two lamps from the existing fixtures, 50 percent of the fixture energy use can be saved with a ten-percent reduction in current lighting levels. Since task lighting is also utilized in this area, this modification will not adversely affect the electronics repair activities. This project consists of the removal of two lamps and one ballast from each four-tube fluorescent fixture, installation of a specular-anodized aluminum reflector, and if necessary, repositioning of the lamp connectors.

Recommendations

Based on the Life Cycle Cost Analysis, this ECO is recommended.

Construction Cost	$32,017
Annual Energy Savings (MBtu/yr)	
Electricity	613
Annual Energy Cost Savings ($/yr)	$6,711
SIR	2.8
Simple Payback (years)	5.3

LIFE CYCLE COST ANALYSIS SUMMARY   STUDY: ECO8
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)   LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #8 FLUORESCENT REFLECTORS FOR BUILDING 370
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	32017.
B. SIOH	$	1761.
C. DESIGN COST	$	1921.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	35699.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	613.	$ 6711.	15.11	101397.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	0.	$ 0.	25.22	0.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		613.	$ 6711.		$ 101397.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 33461.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 6711.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 101397.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 2.84
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 5.32

ECO Number: 9

PAINT BOOTH FAN CONTROL

Discussion

Paint booth exhaust fans operate continuously during the shift when painting is to be done. However, the fan is required to operate only when paint is being applied.

This ECO provides controls for nine paint booths that will turn the fan off if no one has been in the paint booth for three minutes, and will turn it on whenever any one enters the booth.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

Construction Cost	$4,604
Annual Energy Savings (MBtu/yr)	
No. 6 Oil	4,895
Electricity	124
Annual Energy Cost Savings ($/yr)	$22,900
SIR	71.0
Simple Payback (years)	0.2

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECO9
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #9 PAINT BOOTH FAN CONTROLS
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 15 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

A. CONSTRUCTION COST	$	4604.
B. SIOH	$	254.
C. DESIGN COST	$	277.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	5135.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	124.	$ 1357.	10.75	14583.
B. DIST	$ 4.98	0.	$ 0.	14.08	0.
C. RESID	$ 4.41	4895.	$ 21587.	16.21	349924.
D. NAT G	$ .00	0.	$ 0.	13.25	0.
E. COAL	$ .00	0.	$ 0.	11.13	0.
F. TOTAL		5019.	$ 22944.		$ 364507.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 10.59
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 120287.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 22944.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 364507.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 70.98
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 .22

ECO Number: 10

DRIVE-IN PAINT BOOTH AIR FLOW CONTROL

Discussion

The two paint booths in Building 350 and the eight in Building 320 are large enough to enclose large tracked and wheeled vehicles. Supply air fans move outside air across a steam coil and into the paint booth. The exhaust fans draw air and fumes from the booth and discharge them to the atmosphere. Because of the variable pressure drops caused by the filters and the unsteady building negative pressure, the fans are hard to balance. This imbalance sometimes causes low air flows, a violation of OSHA regulations, and positive booth pressure which releases paint fumes into the building, a fire hazard. Additionally, the fans are allowed to operate at all times, even though no painting is being done because, while running, they prevent cold air from being drawn back into the booth by the negative pressure in the building. During the winter this back flow would allow cold air to blow on a freshly painted vehicle potentially ruining the paint job, and making the surroundings uncomfortably cold.

The recommended controls would solve all of these problems. Both supply and exhaust air fans are supplied with variable frequency (variable speed) drives and analog control loops. The supply air fans would supply the required flow, and the exhaust fans would maintain the required negative pressure. The supply air fan would supply the required air flow even if the filters get a little plugged, or if the building pressure were to change. Likewise, the exhaust fan would remove just enough air to keep the booth under a slightly negative pressure relative to the building interior. When painting is stopped, and the booth doors opened, the fans (supply and exhaust) would reduce speed to minimize backdraft air flow. Furthermore, in a manual mode, the controls will allow accelerated warm-up of cold vehicles inside the booth. This would liberate the valuable floor space in Building 350, now used for this purpose, for other, more productive activities.

The recommended fan controls optimize booth air flow and pressure while painting is under way and reduces air flow to a minimum when there are no

painting activities. These controls will save energy through reduced electrical consumption and reduced fuel consumption.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

Construction Cost	$212,670
Annual Energy Savings (MBtu/yr)	
Electricity	1,503
No. 6 Fuel Oil	4,397
No. 2 Fuel Oil	5,674
Annual Energy Cost Savings ($/yr)	$64,100
SIR	3.8
Simple Payback (years)	3.7

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECO10
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #10 PAINT BOOTH AIR FLOW CONTROL
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 15 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

A. CONSTRUCTION COST	$	212670.
B. SIOH	$	11697.
C. DESIGN COST	$	12761.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	237128.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	1503.	$ 16443.	10.75	176760.
B. DIST	$ 4.98	5674.	$ 28257.	14.08	397852.
C. RESID	$ 4.41	4397.	$ 19391.	16.21	314324.
D. NAT G	$ .00	0.	$ 0.	13.25	0.
E. COAL	$ .00	0.	$ 0.	11.13	0.
F. TOTAL		11574.	$ 64090.		$ 888937.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 10.59
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 293349.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 64090.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 888937.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 3.75
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 3.70

ECO Number: 11

BLAST BOOT FAN SHUT-OFF (BUILDINGS 350 AND 37)

Discussion

The blast booth exhaust fan draws air from the building interior, circulates it through the booth and a bag house, and discharges it back into the building. This fan must be operated whenever blasting is under way. However, there is no reason for the fan to operate when the blast booth is not being utilized and the doors are open.

This ECO provides electrical equipment that will automatically stop the exhaust fan when the large booth doors are not fully closed. One limit switch mounted on each pair of doors will indicate the doors are closed and the fan may be started. The fan will operate until one of the large doors opens, or until the stop button is depressed.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

Construction Cost	$6,529
Annual Energy Savings (MBtu/yr)	
Electricity	1,610
Annual Energy Cost Savings ($/yr)	$17,613
SIR	26.0
Simple Payback (years)	0.4

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECO11
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #11 BLAST BOOTH FAN CONTROL (B350)
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 15 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

A. CONSTRUCTION COST	$	6529.
B. SIOH	$	359.
C. DESIGN COST	$	392.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	7280.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	1610.	$ 17613.	10.75	189344.
B. DIST	$ 7.43	0.	$ 0.	14.08	0.
C. RESID	$ 6.61	0.	$ 0.	16.21	0.
D. NAT G	$ .00	0.	$ 0.	13.25	0.
E. COAL	$ .00	0.	$ 0.	11.13	0.
F. TOTAL		1610.	$ 17613.		$ 189344.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 10.59
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 62484.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 17613.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 189344.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 26.01
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 .41

ECO Number: 12

BOILER CONVERSION TO NUMBER 5 FUEL OIL

Discussion

Twenty-six buildings, housing 35 boilers, currently burning No. 2 fuel oil were evaluated for switching to No. 5 fuel oil. No energy is saved, but there will be a cost saving due to the fuel differential cost.

No. 5 fuel oil is 11 percent less expensive than No. 2 fuel oil on a per Btu basis. This ECO evaluates the benefits of changing to No. 5 fuel oil wherever No. 2 is currently used. Oil heaters and minor fuel piping changes are all that is required.

If this project is implemented, all other projects in this report that were designed to save heating fuel will experience a decrease in energy cost savings and a corresponding increase in simple payback.

Recommendations

Based on the Life Cycle Cost Analysis plus additional maintenance concerns and fuel heating energy costs, fuel switching is not recommended for eight boilers in Buildings 2, 8, 37 and 320.

Construction Cost	$89,656
Annual Energy Savings (MBtu/yr)	
No. 2 Fuel Oil	32,504
No. 5 Fuel Oil	(32,504)
Annual Energy Cost Savings ($/yr)	$26,653
SIR	-2.7
Simple Payback (years)	3.8

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: EC012
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #12 BOILER CONVERSION TO #5 FUEL OIL
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-30-91 ECONOMIC LIFE 25 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

A. CONSTRUCTION COST	$	89656.
B. SIOH	$	4931.
C. DESIGN COST	$	5380.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	99967.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 7.43	32504.	$ 241505.	21.31	5146466.
C. RESID	$ 6.61	-32504.	$ -214851.	25.22	-5418553.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		0.	$ 26653.		$ -272088.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ -89789.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F) -3.62
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 26653.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ -272088.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= -2.72
(IF < 1 PROJECT DOES NOT QUALIFY)

**** Project does not qualify for ECIP funding; 4,5,6 for information only.

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 3.75

ECO Number: 13

ENERGY-EFFICIENT LAMPS FOR BUILDING 370

Discussion

The casing repair area of Building 370 has about 450 pendant-mounted, fluorescent light fixtures. Each one of these fixtures has four 40-watt lamps. Task lights are used at the work surface in addition to these overhead light fixtures. About 15 percent of the energy used by each fixture can be saved by replacing the existing 40-watt lamps with energy-efficient, 34-watt lamps. Lighting levels will also be reduced by about 15 percent. This project includes the removal of the existing lamps and installation of new 34-watt, energy-efficient lamps on a one-for-one basis.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

Construction Cost	$18,388
Annual Energy Savings (MBtu/yr)	
Electricity	153
Annual Energy Cost Savings ($/yr)	$1,677
SIR	1.2
Simple Payback (years)	12.2

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECO13
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #13 ENERGY EFFICIENT LAMPS FOR BUILDING 370
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	18388.
B. SIOH	$	1012.
C. DESIGN COST	$	1104.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	20504.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	153.	$ 1677.	15.11	25341.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	0.	$ 0.	25.22	0.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		153.	$ 1677.		$ 25341.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 8363.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 1677.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 25341.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.24
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 12.23

ECO Number: 14

ENERGY-EFFICIENT FREQUENCY CONVERTERS IN BUILDING 370

Discussion

Most of the electronic missile control and testing equipment operates on 400-cycle AC power. Frequency converters are used to convert the 60-cycle power which comes into Building 370 to 400-cycle power. There are 15 frequency converters in Building 370; ten motor-generator-type units and five solid state units. The solid state frequency converters are much more efficient than the motor-generator-type units. This project would consist of replacing three of the existing Hollingsworth motor-generator units with new solid state units. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended. A review of LEAD maintenance records showed no savings in maintenance costs for the solid state over the motor-generator units.

Construction Cost	$139,769
Annual Energy Savings (MBtu/yr)	
Electricity	567
Annual Energy Cost Savings ($/yr)	$6,203
SIR	0.6
Simple Payback (years)	25.1

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: EC014
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #14 ENERGY EFFICIENT FREQUENCY CONVERTERS
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-01-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	139769.
B. SIOH	$	7688.
C. DESIGN COST	$	8387.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	155844.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	567.	$ 6203.	15.11	93727.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	0.	$ 0.	25.22	0.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		567.	$ 6203.		$ 93727.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 30930.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 6203.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 93727.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= .60
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 25.12

ECO Number: 15

MODULAR OFFICES IN BUILDINGS 6 SOUTH, 8 AND 9

Discussion

The temperature in these warehouses is maintained at 68°F (and higher) primarily for operator comfort. A tremendous amount of energy is required to heat the entire warehouse to 68°F. This project consists of installing modular 10 X 12 foot offices inside these warehouses, maintaining 68°F in the offices and reducing the temperature of the warehouse to 55°F. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

Construction Cost	$23,352
Annual Energy Savings (MBtu/yr)	
No. 2 Fuel Oil	2,775
Electricity	(20)
Annual Energy Cost Savings ($/yr)	$13,600
SIR	11.2
Simple Payback (years)	1.9

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECO15
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #15 MODULAR OFFICES IN WAREHOUSING
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	23352.
B. SIOH	$	1285.
C. DESIGN COST	$	1402.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	26039.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-20.	$ -219.	15.11	-3306.
B. DIST	$ 4.98	2775.	$ 13820.	21.31	294494.
C. RESID	$ 4.41	0.	$ 0.	25.22	0.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		2755.	$ 13601.		$ 291187.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 96092.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 13601.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 291187.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 11.18
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 1.91

ECO Number: 16

CONVERSION FROM FUEL OIL TO NATURAL GAS FOR BOILERS IN BUILDINGS 1, 2, 3, 8, 37, 57, 320, 349, 423 AND 2360

Discussion

All of the boilers at LEAD currently burn fuel oil to supply the industrial process and space heating requirements. Significant financial and environmental benefits can be achieved by converting the largest energy consuming boilers to operate on natural gas. Natural gas currently costs \$3.88 per MBtu which is 48 percent less than fuel oil No. 2 (\$7.43 per MBtu) and 41 percent less than fuel oil No. 5 and fuel oil No. 6 (\$6.61 per MBtu).

This project consists of constructing a natural gas pipeline from an existing Consolidated Natural Gas transmission line through LEAD (a total of about nine miles long) and to Buildings 1, 2, 3, 8, 37, 57, 320, 349, 423 and 2360. A measuring, heating, odorization and regulating station is included in the pipeline construction. LEAD will pay for all pipeline construction and the addition of dual fuel burners on the boilers in the above-mentioned buildings. This project was proposed by the People's Natural Gas Company in April 1989. The construction costs were escalated to 1991 using ENR indices and the contract price for natural gas was obtained from People's Natural Gas.

If this project is accepted, funded and implemented, all other projects in this report that were designed to save heating fuel will experience a decrease in energy cost savings and a corresponding increase in simple payback.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

Construction Cost	\$2,289,249
Annual Energy Savings (MBtu/yr)	
No. 2 Oil	36,513
Nos. 5 and 6 Oil	226,569
Natural Gas	(263,082)

Annual Energy Cost Savings ($/yr)	$160,200
SIR	3.1
Simple Payback (years)	15.9

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: EC016

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.062

INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #16 BOILER CONVERSION TO NATURAL GAS
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$ 2289249.
B. SIOH	$ 125909.
C. DESIGN COST	$ 137355.
D. SALVAGE VALUE COST	-$ 0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$ 2552513.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 4.98	36513.	$ 181835.	21.31	3874898.
C. RESID	$ 4.41	226569.	$ 999169.	25.22	25199050.
D. NAT G	$ 3.88	*******	$-1020758.	20.70	-21129700.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		0.	$ 160246.		$ 7944250.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 2621603.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 160246.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 7944250.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 3.11
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 15.93

ECO #D-UP (Project D Update)

COMBINATION PROJECT: <u>EXHAUST HEAT RECOVERY, BUILDINGS 37 AND 350 AND ENGINE TEST CELL HEAT RECOVERY, BUILDING 37</u>

Discussion

D(Part 1): EXHAUST HEAT RECOVERY, SMALL PARTS PAINT FACILITY, BUILDING 350

The original project examined heat recovery from three areas--paint booth (#61), a pre-drying booth and a drying oven. At the time of this report, the drying oven no longer exists and the fan motor for the pre-drying booth has been removed. This portion of the project was updated based on savings from heat recovery at paint booth #61.

D(Part 2): EXHAUST HEAT RECOVERY, P.B. #280, BUILDING 37

This project was re-evaluated using information from the "Paint and Drying Booth" Report by BK&A, August 1987. Fuel savings were updated using current boiler system efficiencies and fuel prices. Cost estimates were escalated using ENR indices.

D(Part 3): ENGINE TEST CELL HEAT RECOVERY, BUILDING #37

Building 37 contains eight engine test cells where vehicle engines are operated and their performance evaluated. Currently, the engine and dynamometer cooling water is pumped to a cooling tower for heat removal. Recovering this heat energy for other uses within the building will save energy. The original project analysis assumed that energy recovered would be used to preheat boiler feedwater used for "steam" cleaning processes. It was noted that "steam" clean wands were left on continuously and therefore, a year-round, constant steam requirement was available. Current operation is much more intermittent in usage and there will be times when engines are being tested and "steam" cleaning not operational. The proposed system was redesigned to accommodate this situation. However, the new design does not recover engine exhaust gas heat due to control complexities which may affect performance tests.

Energy savings were calculated for the new design and capital costs were escalated to the present using ENR indices. The results of the three-part project are summarized below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1983 Projected	1991 Estimate
Construction Cost	$116,365	$160,186	$294,409
Annual Energy Savings (MBtu/yr)			
No. 2 Fuel Oil	2,182	2,182	425
No. 5 Fuel Oil	--	--	1,083
No. 6 Fuel Oil	2,079	2,079	1,166
Electricity	(66)	(66)	(750)
Annual Energy Cost Savings ($/yr)	$21,875	$33,264	$9,819
SIR	--	--	1.0
Simple Payback (years)	5.3	4.6	33.4

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECODUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #D-UP PAINT BOOTH & ENGINE HEAT RECOVERY
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	294409.
B. SIOH	$	16193.
C. DESIGN COST	$	17665.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	328267.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-750.	$ -8205.	15.11	-123978.
B. DIST	$ 7.43	425.	$ 3158.	21.31	67292.
C. RESID	$ 6.61	2249.	$ 14866.	25.22	374918.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		1924.	$ 9819.		$ 318232.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 105017.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 9819.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 318232.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= .97
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 33.43

ECO #E-UP (Project E Update)

VAPOR BARRIER FOR 12 DEHUMIDIFIED WAREHOUSES

Discussion

There are many storage warehouses at LEAD that are maintained at approximately 50 percent relative humidity. Some are heated and have insulation attached to the interior walls. Since the material recommended here requires a clean brick wall, these buildings are not included.

A vapor barrier is evaluated that will decrease the infiltration of water vapor through exterior walls. The vapor barrier is applied to the interior surface of the dehumidified warehouses. It is a chemically active cementitious composition which is applied with a brush.

Since the vapor barrier requires a cementitious surface for attachment, the interior brick walls must be free of insulation. The following buildings fall into this category: 11, 18, 31, 32, 34, 41, 44, 47, 52, 53, 55 and 56.

Construction costs were escalated to January 1991 using ENR indices and energy costs calculated using current values. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1983 Projected	1991 Estimate
Construction Cost	$606,806	$847,571	$758,002
Annual Energy Savings (MBtu/yr)			
Electricity	5,937	5,937	5,937
Annual Energy Cost Savings ($/yr)	$29,660	$45,196	$49,791
SIR	--	--	0.9
Simple Payback (years)	20.5	20.9	17.0

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: ECOEUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #E-UP VAPOR BARRIER FOR WAREHOUSES
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-09-91 ECONOMIC LIFE 25 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	758002.
B. SIOH	$	41691.
C. DESIGN COST	$	45481.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	845174.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	5937.	$ 64951.	15.11	981406.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	0.	$ 0.	25.22	0.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		5937.	$ 64951.		$ 981406.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
1. REAPPLICATION	$-379001.	12	.58	-219821.
d. TOTAL	$-379001.			-219821.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ -219821.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 323864.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 49791.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 761586.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= .90
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 16.97

ECO #G-UP (Project G Update)

EXHAUST HEAT RECOVERY, BUILDING 350 N DIP TANKS

Discussion

The purpose of this ECO is to recover heat from the dip tank exhaust air through the use of a roof-mounted, air-to-air, heat exchanger.

Energy savings were updated for changes in operating schedules, indoor temperatures and boiler system efficiency. Costs were escalated to January 1991 using ENR indices.

Recommendations

ECO #3, Dip Tank Covers with Exhaust Fan Controllers, directly affects the economics of this ECO by reducing the exhaust fan full load operation hours. Also, the heat recovery supply and exhaust fans must be controlled to follow the varying exhaust air volumes resulting from the Dip Tank Cover project. It is also questionable whether or not the system would last 20 years without major maintenance. ECO #3 is recommended for funding with a higher priority than the exhaust heat recovery ECO because of its quick paybacks and simplicity. If ECO #3 is implemented, the SIR and payback for ECO-G-UP are changed to 1.3 and 19.6 years, respectively. Due to the extended payback, maintenance uncertainties and increased complexity caused by the Dip Tank Cover project, this project is not recommended.

	1980 Estimate	1983 Projected	1991 Estimate W/o ECO #3	1991 Estimate With ECO #3
Construction Cost	$157,828	$221,737	$213,404	$213,404
Annual Energy Savings (MBtu/yr)				
Electricity	(273)	(273)	(107)	(107)
No. 6 Fuel Oil	5,332	5,332	6,453	2,886
Annual Energy Cost Savings ($/yr)	$18,259	$27,785	$27,300	$11,600
SIR	--	3.0	2.9	1.3
Simple Payback (years)	8.6	8.2	8.7	20.0

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-UP DIP TANK EXHAUST HEAT RECOVERY
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

A. CONSTRUCTION COST	$	213404.
B. SIOH	$	11738.
C. DESIGN COST	$	12805.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	237947.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-107.	$ -1171.	15.11	-17687.
B. DIST	$ 4.98	0.	$ 0.	21.31	0.
C. RESID	$ 4.41	6453.	$ 28458.	25.22	717704.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		6346.	$ 27287.		$ 700016.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 231005.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 27287.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 700016.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 2.94
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 8.72

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGUPA
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY A.REGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO G-UP-A DIP TANK EXHAUST HEAT RECOVERY
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	213404.
B. SIOH	$	11738.
C. DESIGN COST	$	12805.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	237947.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-107.	$ -1171.	15.11	-17687.
B. DIST	$ 4.98	0.	$ 0.	21.31	0.
C. RESID	$ 4.41	2886.	$ 12727.	25.22	320981.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		2779.	$ 11557.		$ 303294.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 100087.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 11557.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 303294.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.27
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 20.59

ECO #H-UP (Project H Update)

INSULATE BAGHOUSES IN BUILDINGS 1 NORTH, 37 AND 350

Discussion

Baghouses (dust collectors) are used to filter air exhausted from abrasive blast booths and return the air to the building for reuse. Since the baghouse and associated ductwork are exterior to the building and exposed to ambient conditions, energy could be saved if they were insulated. The baghouses in Building 350 return the exhausted air to the building; this is not done in Buildings 1 and 37. Insulation projects for these baghouses includes returning exhausted air to the building.

Construction costs were escalated to January 1991 using ENR indices and energy costs calculated using current values. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

	1980 Estimate	1983 Projected	1991 Estimate
Construction Cost	$100,864	$140,848	$125,743
Annual Energy Savings (MBtu/yr)			
No. 5 Fuel Oil	927	927	1,145
No. 6 Fuel Oil	1,136	1,136	1,843
Annual Energy Cost Savings ($/yr)	$10,997	$13,407	$13,200
SIR	--	--	2.4
Simple Payback (years)	9.2	10.0	10.6

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
STUDY: ECOHUP
LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY REGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #H-UP BAGHOUSE INSULATION
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	125743.
B. SIOH	$	6916.
C. DESIGN COST	$	7545.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	140204.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 4.98	0.	$ 0.	21.31	0.
C. RESID	$ 4.41	2988.	$ 13177.	25.22	332326.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		2988.	$ 13177.		$ 332326.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 109668.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 13177.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 332326.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 2.37
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 10.64

ECO #I-UP (Project I Update)

EXHAUST HEAT RECOVERY IN BUILDING 350, PAINT BOOTHS #59 AND #60

Discussion

This project was re-evaluated using information from the "Paint and Drying Booth" Report by BK&A, August 1987. Fuel savings were updated using current boiler system efficiencies and fuel prices. The cost estimates were updated using ENR indices.

The BK&A design called for several additional filters and heat exchangers with much higher pressure drops than the design by RS&H. This combination requires new motors and air handling units and, therefore, a much higher cost. Energy savings values from the BK&A report were adjusted for the current boiler system efficiency and operation hours. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1983 Projected	1991 Estimate
Construction Cost	$91,530	$131,092	$362,848
Annual Energy Savings (MBtu/yr)			
No. 6 Fuel Oil	2,424	2,424	3,703
Electricity	(166)	(166)	(1,111)
Annual Energy Cost Savings ($/yr)	$7,093	$12,313	$12,322
SIR	--	--	1.1
Simple Payback (years)	12.9	10.1	32.8

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOIUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #I-UP PAINT BOOTH EXHAUST HEAT RECOVERY (350M)
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	362848.
B. SIOH	$	19957.
C. DESIGN COST	$	21771.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	404576.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-1111.	$ -12154.	15.11	-183652.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	3703.	$ 24477.	25.22	617306.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		2592.	$ 12322.		$ 433654.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 143106.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 12322.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 433654.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.07
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 32.83

ECO #J-UP (Project J Update)

EXHAUST HEAT RECOVERY IN BUILDING 350, PAINT BOOTHS #2527 AND #2541

Discussion

This project was re-evaluated using information from the "Paint and Drying Booth" Report by BK&A, August 1987. Fuel savings were updated using current boiler system efficiencies and fuel prices. The cost estimates were updated using ENR indices.

The BK&A design called for several additional filters and heat exchangers with much higher pressure drops than the design by RS&H. This combination requires new motors and air handling units and, therefore, a much higher cost. Energy savings values from the BK&A report were adjusted for the current boiler system efficiency and operation hours. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1983 Projected	1991 Estimate
Construction Cost	$107,168	$150,563	$362,847
Annual Energy Savings (MBtu/yr)			
No. 6 Fuel Oil	2,388	2,388	3,644
Electricity	(332)	(332)	(1,010)
Annual Energy Cost Savings ($/yr)	$8,300	$11,832	$13,037
SIR	--	--	1.1
Simple Payback (years)	12.9	12.7	31.0

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOJUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #J-UP PAINT BOOTH EXHAUST HEAT RECOVERY
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	362847.
B. SIOH	$	19957.
C. DESIGN COST	$	21771.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	404575.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-1010.	$ -11049.	15.11	-166956.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	3644.	$ 24087.	25.22	607470.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		2634.	$ 13037.		$ 440514.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 145370.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 13037.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 440514.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.09
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 31.03

ECO #N-UP (Project N Update)

WINDOW AND WALL INSULATION IN BUILDINGS 422, 424, 426, 433 AND 436

Discussion

The 400 series buildings considered for this project are shops with large window areas and uninsulated walls. The conduction and infiltration losses without insulation are presently very high during the heating season. This project includes insulation of all non-operable windows, weatherstripping all operable windows and doors, and insulation of all wall areas. Windows will be insulated with three-inch fiberglass batt, and walls will be insulated with one to two inches of spray-on cellulose, all on interior surfaces covered by 1/8-inch hardboard.

Construction costs were escalated to January 1991 using ENR indices and energy cost savings were recalculated using current values including the fuel switch from No. 5 to No. 2 fuel oil. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

	1980 Estimate	1983 Projected	1991 Estimate
Construction Cost	$88,593	$123,711	$115,930
Annual Energy Savings (MBtu/yr)			
No. 2 Fuel Oil	-	-	2,749
No. 5 Fuel Oil*	1,196	1,196	-
Annual Energy Cost Savings ($/yr)	$5,980	$9,090	$13,700
SIR	--	--	2.3
Simple Payback (years)	14.8	13.6	9.4

*Note: The increase in energy savings for the 1991 estimate are due to changes in building indoor temperature assumptions (see Appendix B for details).

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECONUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #N-UP WINDOW & WALL INSULATION
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	115930.
B. SIOH	$	6377.
C. DESIGN COST	$	6956.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	129263.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 4.98	2749.	$ 13690.	21.31	291734.
C. RESID	$ 4.41	0.	$ 0.	25.22	0.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		2749.	$ 13690.		$ 291734.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 96272.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 13690.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 291734.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 2.26
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 9.44

ECO #R-UP (Project R Update)

HIGH-PRESSURE SODIUM LIGHTING IN BUILDINGS 31, 32, 33, 34, 41, 42, 43 AND 44

Discussion

This project was originally designed for replacement of existing fluorescent and mercury-vapor lighting with new high-pressure sodium light fixtures. Due to the high initial cost and small savings potential, the payback was over 100 years. There is a very low watt-per-fixture difference (four watts) between the fluorescent fixtures and the HPS fixtures, so those lamps were not included in this update. This project consists of replacing 873 175-watt mercury-vapor light fixtures with 100 watt high-pressure sodium fixtures.

Construction costs were escalated to January 1991 using ENR indices and energy cost savings were recalculated using current values. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1983 Projected	1991 Estimate
Construction Cost	$358,337	$500,385	$272,226
Annual Energy Savings (MBtu/yr)			
Electricity	1,754	1,754	465
Annual Energy Cost Savings ($/yr)	$2,578	$3,929	$5,087
SIR	--	--	0.3
Simple Payback (years)	139.0	127.4	60.0

LIFE CYCLE COST ANALYSIS SUMMARY　　STUDY: ECORUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)　　LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #R-UP HIGH PRESSURE SODIUM LIGHTING
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	272226.
B. SIOH	$	14973.
C. DESIGN COST	$	16334.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	303533.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	465.	$ 5087.	15.11	76866.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	0.	$ 0.	25.22	0.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		465.	$ 5087.		$ 76866.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)　　$ 0.
(1) DISCOUNT FACTOR (TABLE A)　　14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1)　　$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$　　0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33)　　$ 25366.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$　　5087.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)　　$ 76866.

6. DISCOUNTED SAVINGS RATIO　　(SIR)=(5 / 1F)=　　.25
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED)　　SPB=1F/4　　59.67

ECO #G-E-UP (Project G-E Update)

EXHAUST HEAT RECOVERY, BUILDING 1 NORTH, PAINT BOOTH #1010

Discussion

This project was re-evaluated using information from the "Paint and Drying Booth" Report by BK&A, August 1987. Fuel savings were updated using current boiler system efficiencies, fuel prices and paint booth operating hours. Cost estimates were updated using ENR indices.

The BK&A design called for several additional filters and heat exchangers with much higher pressure drops than the design by RS&H. This combination requires new motors and air handling units and, therefore, a much higher cost. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1984 Projected	1991 Estimate
Construction Cost	$36,819	$55,839	$109,783
Annual Energy Savings (MBtu/yr)			
No. 5 Fuel Oil	817	817	510
Electricity	(26)	(26)	(141)
Labor and Material Increase	$429	$562	--
Annual Energy Cost Savings ($/yr)	$4,551	$7,015	$1,829
SIR	--	--	0.5
Simple Payback (years)	9.0	8.9	66.9

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGEUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-E-UP PAINT BOOTH EXHAUST HEAT RECOVERY (1N)
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	109783.
B. SIOH	$	6038.
C. DESIGN COST	$	6587.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	122408.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-141.	$ -1543.	15.11	-23308.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	510.	$ 3371.	25.22	85019.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		369.	$ 1829.		$ 61711.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 20365.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 1829.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 61711.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= .50
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 66.94

ECO #G-F-UP (Project G-F Update)

EXHAUST HEAT RECOVERY, BUILDING 14, PAINT BOOTH #252

Discussion

This project was re-evaluated using information from the "Paint and Drying Booth Report" by BK&A, August 1987. Fuel savings were updated using current boiler system efficiencies, fuel prices and paint booth operation hours. Cost estimates were escalated using ENR indices.

The BK&A design called for several additional filters and heat exchangers with much higher pressure drops than the design by RS&H. This combination requires new motors and air handling units and, therefore, a much higher cost. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1984 Projected	1991 Estimate
Construction Cost	$34,159	$51,804	$88,890
Annual Energy Savings (MBtu/yr)			
No. 5 Fuel Oil	644	644	325
Electricity	(15)	(15)	(90)
Annual Energy Cost Savings ($/yr)	$3,964	$5,464	$1,164
SIR	--	--	0.4
Simple Payback (years)	9.6	10.0	85.2

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGFUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-F-UP PAINT BOOTH EXHAUST HEAT RECOVERY (B14)
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	88890.
B. SIOH	$	4889.
C. DESIGN COST	$	5334.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	99113.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-90.	$ -985.	15.11	-14877.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	325.	$ 2148.	25.22	54179.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		235.	$ 1164.		$ 39302.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 12970.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 1164.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 39302.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= .40
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 85.17

ECO #G-G-UP (Project G-G Update)

EXHAUST HEAT RECOVERY, BUILDING 37, PAINT BOOTH #468

Discussion

This project was re-evaluated using information from the "Paint and Drying Booth Report" by BK&A, August 1987. Fuel savings were updated using current boiler system efficiencies, fuel prices and paint booth operation hours. Cost estimates were escalated using ENR indices.

The BK&A design called for several additional filters and heat exchangers with much higher pressure drops than the design by RS&H. This combination requires new motors and air handling units and, therefore, a much higher cost. The results are shown below.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1984 Projected	1991 Estimate
Construction Cost	$34,251	$51,804	$109,783
Annual Energy Savings (MBtu/yr)			
No. 5 Fuel Oil	639	639	393
Electricity	(15)	(15)	(109)
Annual Energy Cost Savings ($/yr)	$3,938	$5,430	$1,405
SIR	--	--	0.4
Simple Payback (years)	9.7	10.6	87.1

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGGUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-G-UP PAINT BOOTH EXHAUST HEAT RECOVERY (B37)
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: P. HUTCHINS

1. INVESTMENT

A. CONSTRUCTION COST	$	109783.
B. SIOH	$	6038.
C. DESIGN COST	$	6587.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	122408.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-109.	$ -1192.	15.11	-18018.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	393.	$ 2598.	25.22	65515.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		284.	$ 1405.		$ 47497.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 15674.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 1405.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 47497.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= .39
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 87.11

ECO #G-I-UP (Project G-I Update)
DIP TANK HEAT RECOVERY BUILDING 350 SOUTH

Discussion

The purpose of this ECO is to recover heat from the exhaust air stream of the dip tanks in the south end of Building 350. The heat recovery technique uses an air-to-air heat exchanger. Energy savings were updated for changes in exhaust flow, indoor temperatures, and boiler system efficiency. Cost estimates were escalated to January 1991 using ENR indices.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1984 Projected	1991 Estimate
Construction Cost	$30,450	$46,374	$38,031
Annual Energy Savings (MBtu/yr)			
No. 6 Fuel Oil	375	375	338
Electricity	(16)	(16)	(78)
Annual Energy Cost Savings ($/yr)	$2,172	$3,304	$1,381
SIR	--	1.6	1.0
Simple Payback (years)	14.0	16.3	30.7

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGIUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-I-UP DIP TANK EXHAUST HEAT RECOVERY (350S)
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

A. CONSTRUCTION COST	$	38031.
B. SIOH	$	2092.
C. DESIGN COST	$	2282.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	42405.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	-78.	$ -853.	15.11	-12894.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	338.	$ 2234.	25.22	56346.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		260.	$ 1381.		$ 43452.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 14339.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 1381.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 43452.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.02
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 30.71

ECO #G-J-UP (Project G-J Update)
EXPAND MAIN STEAM TO BUILDING 320

Discussion

This ECO proposes to replace the boilers in Building 320 with an extension of the steam distribution system from Building 349. The original calculations generated energy savings from a ten-point efficiency difference between the Building 320 and Building 349 boilers coupled with a large energy consumption. Actual 1990 fuel consumption data in Building 320 was one-quarter of the 1981 calculated amount. Furthermore, for the purposes of this study, all Letterkenny boilers are assumed to have the same efficiency (80 percent). Under these conditions, there will be no energy savings and a $7,160 cost savings due to the differential fuel costs.

This project now becomes a simple fuel switch from No. 2 to No. 6 fuel oil. Since No. 5 oil is about the same price as No. 6 oil, it would be cheaper to switch boiler fuels than to extend the steam line.

Recommendations

Based on the Life Cycle Cost Analysis, this ECO is not recommended.

	1980 Estimate	1984 Projected	1991 Estimate
Construction Cost	$762,407	$1,036,699	$1,010,172
Annual Energy Savings (MBtu/yr)			
No. 2 Fuel Oil	12,296	12,296	8,780
No. 6 Fuel Oil	(10,763)	(10,736)	(8,780)
Annual Energy Cost Savings ($/yr)	$33,200	$58,515	$7,160
SIR	--	--	0.0
Simple Payback (years)	23	18	147.4

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGJUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-J-UP EXPAND MAIN STEAM TO BLDG. 320
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

A. CONSTRUCTION COST	$	951999.
B. SIOH	$	52360.
C. DESIGN COST	$	57120.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	1061479.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 7.43	8780.	$ 65235.	21.31	1390166.
C. RESID	$ 6.61	-8780.	$ -58036.	25.22	-1463663.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		0.	$ 7200.		$ -73497.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ -24254.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F) -.09
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 7200.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ -73497.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= -.07
(IF < 1 PROJECT DOES NOT QUALIFY)

**** Project does not qualify for ECIP funding; 4,5,6 for information only.

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 147.44

ECO #G-N-UP (Project G-N Update)

WAREHOUSE DOOR SEALS IN BUILDINGS 2 AND 4

Discussion

Building 2 has 44 cargo doors and Building 4 has 16 cargo doors. Currently, these cargo doors have no seals around their perimeter resulting in excessive infiltration and energy losses while the doors are closed. This project consists of the installation of door seals around the perimeter of both the sliding and roll-up doors. The door seals are made of looped neoprene with an extended aluminum binder. Installing these door seals will reduce the infiltration energy losses by approximately 50 percent.

Construction costs were escalated to January 1991 using ENR indices and energy cost savings were recalculated using current values. The results are shown below. The decrease in annual energy savings is primarily due to the assumption that the existing crack width is smaller than predicted in the original report.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

	1981 Estimate	1984 Projected	1991 Estimate
Construction Cost	$40,996	$55,512	$48,644
Annual Energy Savings (MBtu/yr)			
No. 2 Fuel Oil	--	--	900
No. 5 Fuel Oil	4,875	4,875	1,982
Annual Energy Cost Savings ($/yr)	$30,956	$47,092	$13,200
Additional Maintenance Cost ($/yr)	--	--	$6,922
SIR	--	--	4.0
Simple Payback (years)	1.3	1.2	8.6

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGNUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-N-UP WAREHOUSE DOOR SEALS
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	48644.
B. SIOH	$	2676.
C. DESIGN COST	$	2919.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	54239.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 4.98	900.	$ 4482.	21.31	95511.
C. RESID	$ 4.41	1982.	$ 8741.	25.22	220438.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		2882.	$ 13223.		$ 315950.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ -6922.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ -100577.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ -100577.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 104263.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)_____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 6301.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 215373.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 3.97
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 8.61

ECO #G-P-UP (Project G-P Update)

STRIP CURTAINS FOR WAREHOUSE DOORS IN BUILDINGS 2 AND 4

Discussion

Building 2 has 44 cargo doors and Building 4 has 16 cargo doors. When these doors are open during the winter, a large volume of heated air is lost, and is replaced by cold outside air. This project consists of installing plastic strip curtains on the inside of both the sliding and roll-up doors. There are 32 truck doors in Building 2 covered by the loading dock seal project (G-U-UP) which will not be considered for plastic strip curtains. The curtains are made of vinyl strips and are hung from a tubular rod on swivel hinges.

Construction costs were escalated to January 1991 using ENR indices and energy cost savings were recalculated using current values. The results are shown below. The increase in annual energy savings is the difference in assumptions of the space temperature and the length of time the doors are left open.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1981 Estimate	1984 Projected	1991 Estimate
Construction Cost	$25,505	$34,536	$30,313
Annual Energy Savings (MBtu/yr)			
No. 2 Fuel Oil	--	--	598
No. 5 Fuel Oil	336	336	508
Annual Energy Cost Savings ($/yr)	$2,134	$3,246	$7,801
Additional Maintenance Cost ($/yr)	--	--	$7,190
SIR	--	--	2.2
Simple Payback (years)	11.9	10.6	55.3

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGPUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-P-UP WAREHOUSE STRIP DOOR CURTAINS
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-27-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	30313.
B. SIOH	$	1668.
C. DESIGN COST	$	1819.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	33800.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 7.43	598.	$ 4443.	21.31	94683.
C. RESID	$ 6.61	508.	$ 3358.	25.22	84686.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		1106.	$ 7801.		$ 179369.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ -7190.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ -104471.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ -104471.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 59192.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 611.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 74898.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 2.22
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 55.32

ECO #G-U-UP (Project G-U Update)
STORM WINDOWS ON BUILDING 3

Discussion

Building 3 currently has 1,977 square feet of single-pane windows. Conduction and infiltration losses from these windows are very high during the heating season. This project consists of installing storm windows over the existing windows. Heat losses due to conduction and infiltration will be reduced by approximately 50 percent with storm windows installed.

Construction costs were escalated to January 1991 using ENR indices and energy cost savings were recalculated using current values. The results are shown below. The decrease in annual fuel savings from the previous study is primarily due to the difference in boiler efficiency assumptions.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1980 Estimate	1984 Projected	1991 Estimate
Construction Cost	$23,500	$35,639	$27,624
Annual Energy Savings (MBtu/yr)			
No. 5 Fuel Oil	293	293	255
Annual Energy Cost Savings ($/yr)	$1,862	$2,833	$1,176
SIR	--	--	1.0
Simple Payback (years)	12.6	12.6	26.2

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGUUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-U-UP STORM WINDOWS
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	27624.
B. SIOH	$	1520.
C. DESIGN COST	$	1658.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	30802.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 7.43	0.	$ 0.	21.31	0.
C. RESID	$ 6.61	255.	$ 1686.	25.22	42510.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		255.	$ 1686.		$ 42510.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 14028.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 1686.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 42510.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.38
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 18.27

ECO #G-V-UP (Project G-V Update)

WAREHOUSE LOADING DOCK DOOR SEALS IN BUILDING 2

Discussion

Building 2 has 32 loading docks located along the west wall. During the heating season when trucks are loading and unloading, the large gaps between the truck and the loading dock door allows excessive infiltration losses. Installing loading dock seals will reduce the gap between the truck and the door from about three inches to approximately one-quarter inch. Loading dock seals have already been installed on 12 of 32 doors. This project will consist of the installation of dock seals around the perimeter of the remaining 20 truck doors on the west side of Building 2.

The dock seal is constructed from vinyl-covered foam. There is a counterweighted head pad equipped with guide tracks and a follower curtain to allow for adjustment of the seal to trucks and trailers of different heights.

Construction costs were escalated to January 1991 using ENR indices and energy cost savings were recalculated using current values. The results are shown below. The decrease in annual energy savings is primarily due to having the loading dock door seals installed on 12 of the 32 doors.

Recommendations

Based on the Life Cycle Cost Analysis, this project is not recommended.

	1981 Estimate	1984 Projected	1991 Estimate
Construction Cost	$34,847	$47,185	$25,859
Annual Energy Savings (MBtu/yr)			
No. 5 Fuel Oil	387	387	345
Annual Energy Cost Savings ($/yr)	$2,457	$3,738	$1,500
SIR	--	--	1.3
Simple Payback (years)	14.2	12.6	19.0

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: ECOGVUP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #G-V-UP LOADING DOCK DOOR SEALS
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

A. CONSTRUCTION COST	$	25859.
B. SIOH	$	1423.
C. DESIGN COST	$	1552.
D. SALVAGE VALUE COST	-$	0.
E. TOTAL INVESTMENT (1A + 1B + 1C - 1D)	$	28834.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL	UNIT COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	$ 10.94	0.	$ 0.	15.11	0.
B. DIST	$ 4.98	0.	$ 0.	21.31	0.
C. RESID	$ 4.41	345.	$ 1521.	25.22	38371.
D. NAT G	$ .00	0.	$ 0.	20.70	0.
E. COAL	$ .00	0.	$ 0.	15.93	0.
F. TOTAL		345.	$ 1521.		$ 38371.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-) $ 0.
(1) DISCOUNT FACTOR (TABLE A) 14.53
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 12662.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)______
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE))$ 1521.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 38371.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.33
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 18.95

4.2 Operations and Maintenance Energy Savings

4.2.1 Energy Savings Ideas. As a result of the site visit to LEAD, several operations and maintenance (O&M) energy savings ideas were identified. Energy and economic analyses were performed for these recommendations. The results of these analyses are presented below. Calculations for energy savings can be found in Volume II, Appendix B, under O&M Recommendations.

Upon Failure, Replace Standard Fluorescent Lamps with Energy-Efficient Types

Current practice is to replace failed fluorescent lamps with standard 40-watt lamps. Replacing failed lamps with 34-watt lamps saves about $0.52 per year for each lamp. The incremental cost is the difference between the cost of the two lamps, which is $0.81 per lamp. This yields a payback of about 1.6 years.

Upon Failure, Replace Standard Fluorescent Fixture Ballasts with Energy-Efficient Types

Currently, fluorescent fixtures use standard ballasts. By replacing these ballasts with energy efficient types when they fail, installation charges are avoided and a 20-percent reduction in energy use is accomplished. Estimated savings are about 13 watts per two-lamp fixture or $1.13 per fixture per year. The cost difference between energy-efficient and standard ballasts is about $6.54 per ballast. This yields a simple payback of 5.8 years.

Reduce Auxiliary Steam Use in Building 349

The No. 6 fuel oil storage tanks are reported to overheat during the summer months. Either too much hot oil (200$\pm$ °F) is recirculated to the storage tank from the burner or the tank heater coils are not operating correctly. Operating with oil that is overheated can cause oil pump cavitation, excessive pump wear, vapor lock and ultimately, loss of flame in the boiler. The pressure regulating valve for the recirculation line should be checked for proper operation and settings verified with the manufacturer specifications. Also, the control valves for the tank heaters should be checked. As a test, steam to these heaters could be turned off on the tanks being used while carefully monitoring the tank temperature. Watervliet Arsenal in Albany, New York, operates in this manner with no difficulty even during winter months.

Correcting the overheating problem will produce minimal energy savings because the tanks are heavily insulated. However, the problem should be corrected for safety reasons.

Purchase and Use a Flue Gas Analyzer

Boiler combustion performance should be checked once per month. With more than 30 boilers on site, each boiler would be checked four times per year if two boilers were checked each day. A one-percent increase in boiler efficiency would save $5,500 each year.

Implement Recommendations for Paint Booths

Below are some recommendations based on observations made during our visit.

The continuous air bleed from the bottom of compressed air filter should be stopped.

The compressed air filter should be relocated nearer the operating floor so its condition may be properly monitored, and its performance may be easily maintained.

Supply air temperature indicators and controls should be located on the operating floor.

Breathable air to the spray hoods should be shut off whenever the hood is removed.

Turn Off Air Bleeds on Compressed Air Filters

Throughout the installation air bleeds were found open, particularly those associated with paint sprayers. Operators stated this was necessary to remove water from the compressed air system and protect the paint product. Discussions with the Director of Production Equipment Maintenance indicated that this is not necessary. All compressed air systems for paint sprayers are dried using refrigeration equipment. Closing these air bleeds can save energy and money--approximately $235 per year per leak (see LCNC #8 for detailed calculations).

Turn Off Frequency Converters When Not in Use

Frequency converters located in Building 370 currently operate continuously all year long, although they are required only for two shifts, Monday through Friday. Turning the machines off on nights and weekends would save $10,000 per year.

Replace 1, 1, 1 Trichloroethane (TCE) in Vapor Degreasers With Non-Hazardous Solvent

Vapor degreasers located throughout the production areas use both heating and cooling energy throughout the year. The TCE is boiled in the bottom of the tank producing a vapor above the liquid. To trap the toxic vapor, cooling coils located near the top of the tank cool the vapor to -40°F causing it to condense and fall back into the tank. Since TCE is classified as a hazardous material, it must be carefully handled and disposed in a specific and costly manner.

A replacement non-toxic solvent could be used that would eliminate the need for the cooling coil "vapor trap" and greatly reduce heating requirements. This would save about $6,000 per year. There will also be additional savings due to reduced maintenance and disposal costs.

Move 400-Cycle Testing from First Shift

Currently, the frequency converters are used during the first two shifts. If all ten converters are operated under load simultaneously, an additional 650 kW of electrical demand occurs. This can increase the LEAD electricity bill $4,300 each month if it occurs during peak electricity demand periods. Peak electricity use at LEAD occurs from 0800 to 1500. If these hours are avoided, it is reasonable to expect a $25,000-per-year savings on electricity costs.

Replace Pneumatic Tools with Electrical Types

LEAD uses compressed air to operate a wide variety of hand tools and other machinery. Using compressed air to provide energy for powering hand tools uses about <u>six times</u> more energy than a similar tool utilizing an electric motor. At current electricity prices, the cost savings are about $150 per tool per year.

4.2.2 <u>Operations and Maintenance Instruction Outline</u>. A presentation will be made to LEAD mechanical and electrical maintenance personnel and affected production supervisors to explain energy savings in operations and maintenance. The ideas discussed in Section 4.3.1 were noted during the site survey and will be covered in the course. Below is an outline of the topics that will be presented.

1. LEAD EEAP Industrial Facilities Study description and purpose
2. LEAD energy use data and statistics
3. Fluorescent lighting and ballast maintenance
4. Frequency converter operation
5. Heating plant operation
6. Energy efficient motors
7. Boiler flue gas analyzers
8. Compressed air water removal

4.3 Low Cost/No Cost ECOs

During the site survey, several low cost/no cost energy conservation opportunities were found and are listed in Table 4-5. These were grouped by project type and evaluated for cost effectiveness. Each is analyzed separately and the results are contained in Table 4-6. Detailed calculations can be found in Appendix B.

Below are the low cost/no cost projects evaluated.

- LCNC 1: Close Warehouse Doors When Not in Use
- LCNC 2: Turn Off Unneeded Lights
- LCNC 3: Insulate Steam Pipes
- LCNC 4: Turn Off Equipment When Not in Use
- LCNC 5: Repair Strip Curtains at Conveyor Entrance
- LCNC 6: Install Motion Sensor Lighting Controls
- LCNC 7: Repair Steam Leaks
- LCNC 8: Repair Compressed Air Leaks
- LCNC 9: Delamp in Overlighted Areas

Table 4-5. Low Cost/No Cost ECOs

Building Number	Low Cost/No Cost Energy Conservation Opportunities
2	Close warehouse doors when not in use.
4	Repair steam leak at thermal heating unit #1 (next to northwest wall).
	Turn off exterior lights during day.
5	Turn off incandescent lights in receiving area--HPS lights should be adequate.
	Close warehouse doors when not in use.
6	Repair strip curtains at conveyor entrance.
	Turn off lights at conveyor through 6 North.
	Close warehouse doors when not in use.
7	Turn off lights over rows of bins when not occupied.
	Insulate steam pipes to unit heaters.
	Add threshold to southwest personnel exit door.
8	Add threshold to southwest personnel exit door.
9	Repair steam leak at valve to unit heater supply line.
14	Install motion sensors to turn off lights in shipping and receiving.
19	Close warehouse doors when not in use.
	Turn off exterior lights during the day.
37	Repair compressed air leaks at valves and dryers.
57S	Close gate dampers on vehicle exhaust hoses when not in use.
	Repair compressed air leaks at valves and dryers.
57NC	Repair compressed air leaks at valves and dryers.
320	Repair steam leak--low pressure steam from hose at steam clean station.
	Turn off lights in paint booths when unoccupied.

Table 4-5. Low Cost/No Cost ECOs (Continued)

Building Number	Low Cost/No Cost Energy Conservation Opportunities
	Close warehouse doors when not in use.
370	Turn off frequency converters during the night and on weekends.
	Turn off lights in paint booths when unoccupied.
	Repair air leaks from hoise and valves on the side of blast booth #5259.
422	Insulate bare steam lines within building.
424	Insulate bare steam lines within building.
	Delamp areas over cutting and sewing tables.
431	Install motion sensors in modular laboratories to control lights.

LCNC 1--CLOSE WAREHOUSE DOORS WHEN NOT IN USE

Warehouse doors were found open in Buildings 2, 5, 6-South, 19 and 230. Keeping these doors closed while not in use during the heating season can save a significant amount of fuel oil.

Project Cost

Manhours	0
Labor	$0
Material	$0
Total	$0

Savings

Energy		
	#2 Fuel Oil	69 MBtu/year
	#5/6 Fuel Oil	103 MBtu/year
Cost		$817/year

LCNC 2--TURN OFF UNNEEDED LIGHTS

Lights were found on in areas when unnecessary in buildings 4, 5-North, 6-North, 7, 19, 320 and 370. Electricity savings can be achieved by turning off these lights when they are not required.

Project Cost

Manhours	0
Labor	$0
Material	$0
Total	$0

Savings

Energy (Electricity)	172 MBtu/year
Cost	$1,874/year

LCNC 3--**INSULATE STEAM PIPES**

Buildings 7, 422 and 424 are currently overheated due to the presence of uninsulated steam supply pipes along the building ceilings and partially along walls. Energy can be saved by insulating these lines and allowing the unit heaters and accompanying thermostats to control indoor setpoints.

Project Cost

Manhours	117
Labor	$1,892
Material	$5,054
Total	$6,946

Savings

Energy (#2 Fuel Oil)	1,567 MBtu/year
Cost	$7,804/year

LCNC 4--TURN OFF EQUIPMENT WHEN NOT IN USE

The frequency converters in Building 370 can be turned off at night and on weekends.

Project Cost

Manhours	0
Labor	$0
Material	$0
Total	$0

Savings

Energy (Electricity)	923 MBtu/year
Cost	$10,087/year

LCNC 5--REPAIR STRIP CURTAINS

The strip curtains at the conveyor entrance to Building 6 are displaced. Energy is being wasted due to infiltration through the conveyor opening.

Project Cost

Manhours	0.25
Labor	$4
Materials	$0
Total	$4

Savings

Energy (#2 Fuel Oil)	543 MBtu/year
Cost	$2,704/year

LCNC 6--INSTALL MOTION SENSOR LIGHTING CONTROLS

Areas in Buildings 14 and 431 are not occupied for the entire shift. Motion sensors will turn the lights off when the areas are unoccupied.

Project Cost

Manhours	16
Labor	$268
Materials	$400
Total	$668

Savings

Energy (Electricity)	95.5
Cost	$1,043

LCNC 7--REPAIR STEAM LEAKS

Steam leaks were found in Buildings 4, 9 and 320. Generally, the leaks were at valves and fittings which would require replacement. However, since steam leaks are so costly, this is a cost effective project.

Project Cost

Manhours	16
Labor	$259
Materials	$1,905
Total	$2,164

Savings

Energy (#5/6 Fuel Oil)	936 MBtu/year
Cost	$4,128/year

LCNC 8--REPAIR COMPRESSED AIR LEAKS

Compressed air leaks were noted at valves and air dryers in Buildings 37, 57-South and 370. Repairing these leaks would save compressor operating time and energy.

Project Cost

Manhours	100
Labor	$1,617
Materials	$3,750
Total	$5,367

Savings

Energy (Electricity)	1,100 MBtu/year
Cost	$11,750

LCNC 9--DELAMP IN OVERLIGHTED AREAS

The sewing table and cutting table areas of Building 424 are currently overlit. By removing 50 percent of the fixtures and utilizing the task lighting, the light levels and energy consumption can be reduced to more acceptable values.

Project Cost

Manhours	32
Labor	$536
Materials	$0
Total	$536

Savings

Energy (Electricity)	45 MBtu/year
Cost	$749/year

Table 4-6. Low Cost/No Cost Projects

Number	Cost	Energy Savings (MBtu/yr) Fuel Oil #2	#5/6	Electricity	Energy Cost Savings ($/yr)
LCNC 1	0	172	0	0	$817
LCNC 2	0	0	0	172	$1,874
LCNC 3	$6,946	1,567	-	0	$7,804
LCNC 4	0	0	0	923	$10,087
LCNC 5	$4	543	-	0	$2,704
LCNC 6	$668	0	0	96	$1,043
LCNC 7	$2,164	-	936	0	$4,314
LCNC 8	$5,367	0	0	1,100	$11,750
LCNC 9	$536	0	0	45	$749
TOTALS	$15,685	2,282	936	2,336	$41,142
		3,218			

4.4 Solar Energy Applications

The potential for application of solar (thermal) energy was evaluated with respect to available loads and economics.

The LEAD processes that can utilize solar energy for heating include dip tanks, pressure washing and space heating. The space heating systems currently utilize steam so some modifications to the building's piping system would be required.

The calculations assumed there would be a constant load during solar energy systems' operating hours. The economic analysis compared the cost of heating with solar energy to the current cost of heating with No. 2 fuel oil ($7.43 per MBtu). The results indicate that the simple payback for a solar heating system is approximately 52 years. Therefore, solar process heating is not recommended as an energy conservation measure.

Calculations and cost estimates for this project are located in Appendix B.

5.0 ENERGY PLAN

5.1 Project Packaging

The ECOs listed in Table 4-2 were evaluated for appropriate funding category. The project scope of work listed the following guidelines on this subject.

	Project Cost	Simple Payback
QRIP	\$5,000-\$100,000	≤ 2 yrs.
OSD PIF	> \$100,000	≤ 4 yrs.
PECIP	> \$100,000	≤ 4 yrs.
ECIP	> \$200,000	≤ 10 yrs., SIR > 1.0
MCA	> \$200,000	≤ 25 yrs., ≥ 8 yrs.

DA Form 1391 is required only for those ECIP and MCA projects costing greater than \$200,000. Otherwise, DA Form 5108-R from AR 5-4 is used.

Table 5-1 contains the results of the analysis with the project funding category listed in the far right column and is summarized in Table 5-2. Table 5-3 lists the ECOs by project funding category.

ECOs #8, Fluorescent Fixture Reflectors; G-N-UP, Warehouse Door Seals and N-UP, Window and Wall Installation could have qualified for ECIP funding except none met the minimum project cost of \$200,000. Since the ECOs were not related in any manner, they were not combined.

ECOs H-UP, Baghouse Insulation; #13, Energy Efficient Fluorescent Lamps; and G-V-UP, Loading Dock Door Seals met all the MCA criteria except for the \$200,000 minimum project cost.

ECO G-UP, Dip Tank Exhaust Heat Recovery, was re-evaluated to determine the synergistic effects when ECO #3, Dip Tank Covers with Exhaust Fan Controls is implemented. The results are shown under ECO G-UP-A. This ECO narrowly meets the MCA requirements, but is not recommended because of increased complexity due to interaction with ECO #3 maintenance uncertainties and long payback period of 20 years.

Table 5-1. ECO Evaluations - Project Funding

No.	ECO #	Construction Cost Plus SIOH	Savings (Increase), MBtu/Year Elec	Dist	Resid	N Gas	Net Cost Savings	SIR	Simple Payback (Years)	Project Funding
1	9	$4,858	124	-	4,895	-	$22,900	71.0	0.2	QRIP
2	11	$6,888	1,610	-	-	-	$17,613	26.0	0.4	QRIP
3	6	$2,557	-	-	938	-	$4,100	38.6	0.7	QRIP
4	3	$198,942	2,496	-	26,034	-	$137,400	10.0	1.5	OSD PIF
5	15	$24,637	(20)	2,775	-	-	$13,600	11.2	1.9	QRIP
6	1	$7,671	366	-	-	-	$4,004	7.5	2.0	QRIP
7	5	$172,629	2,640	-	6,536	-	$57,700	4.3	3.2	OSD PIF
8	10	$224,367	1,503	5,674	4,397	-	$64,100	3.8	3.7	OSD PIF
9	12	$94,587	-	32,504	(32,504)	-	$26,653	-2.7	3.8	NR
10	8	$33,778	613	-	-	-	$6,711	2.8	5.3	NF
11	G-N-UP	$51,320	-	900	1,982	-	$6,300	4.0	8.6	NF
12	G-UP	$225,142	(107)	-	6,453	-	$27,300	2.9	8.7	NR
13	N-UP	$122,307	-	-	2,749	-	$13,700	2.3	9.4	NF
14	H-UP	$132,659	-	-	2,988	-	$13,200	2.4	10.6	NF
15	13	$19,400	153	-	-	-	$1,677	1.2	12.2	NF
16	16	$2,415,158	-	36,513	226,569	(263,082)	$160,200	3.1	15.9	MCA
17	E-UP	$799,693	5,937	-	-	-	$49,791	0.9	17.0	NR
18	G-V-UP	$27,282	-	-	345	-	$1,500	1.3	18.1	NF
19	G-UP-A	$225,142	(107)	-	2,886	-	$11,600	1.3	20.0	NR
20	14	$147,457	567	-	-	-	$6,203	0.6	25.1	NR
21	G-U-UP	$29,144	-	-	255	-	$1,176	1.0	26.2	NR
22	G-I-UP	$40,123	(78)	-	338	-	$1,381	1.0	30.7	NR
23	J-UP	$382,804	(1,010)	-	3,644	-	$13,037	1.1	31.0	NR
24	I-UP	$382,805	(1,111)	-	3,703	-	$12,322	1.1	32.8	NR
25	D-UP	$310,602	(750)	425	2,249	-	$9,819	1.0	33.4	NR
26	G-P-UP	$31,981	-	598	508	-	$611	2.2	55.3	NR
27	R-UP	$287,199	465	-	-	-	$5,087	0.3	59.7	NR
28	G-E-UP	$115,821	(141)	-	510	-	$1,829	0.5	67.0	NR
29	G-F-UP	$93,779	(90)	-	325	-	$1,164	0.4	85.2	NR
30	G-G-UP	$115,821	(109)	-	393	-	$1,405	0.4	87.1	NR
31	G-J-UP	$1,065,732	-	8,780	8,780	-	$7,200	0.0	147.4	NR
32	4	-	-	-	-	-	-	-	-	-
33	7	-	-	-	-	-	-	-	-	-
34	2	$15,985	-	-	-	-	-	-	-	-

NF - SIR > 1, but does not meet recommended funding requirements.

NR - Not recommended.

Table 5-2. ECO Evaluations - Project Funding Summary

No.	ECO #	Title: ECO Names	Construction Cost Plus SIOH	SIR	Simple Payback (Years)	Project Funding
1	9	Paint booth fan control	$4,858	71.0	0.2	QRIP
2	11	Blast booth fan cut off	$6,888	26.0	0.4	QRIP
3	6	Heat recovery from condensate	$2,557	38.6	0.7	QRIP
4	3	Dip tank covers with exhaust fan controls	$198,942	10.0	1.5	OSD PIF
5	15	Modular offices	$24,637	11.2	1.9	QRIP
6	1	Compressed air valve replacement	$7,671	7.5	2.0	QRIP
7	5	EMCS in Building 370	$172,629	4.3	3.2	OSD PIF
8	10	Paint booth air flow control	$224,367	3.8	3.7	OSD PIF
9	12	Boiler conversion to #5 fuel oil	$94,587	-2.7	3.8	NR
10	8	Reflectors for fluorescent fixtures	$33,778	2.8	5.3	NF
11	G-N-UP	Warehouse door seals in Buildings 2 and 4	$51,320	4.0	8.6	NF
12	G-UP	Dip tank exhaust heat recovery	$225,142	2.9	8.7	NR
13	N-UP	Window and wall insulation in 400-series buildings	$122,307	2.3	9.4	NF
14	H-UP	Baghouse insulation and exhaust air return	$132,659	2.4	10.6	NF
15	13	Energy efficient fluorescent lamps	$19,400	1.2	12.2	NF
16	16	Boiler conversion to natural gas	$2,415,158	3.1	15.9	MCA
17	E-UP	Vapor barrier for dehumidified warehouses	$799,693	0.9	17.0	NR
18	G-V-UP	Loading dock seals for Building 2	$27,282	1.3	18.1	NF
19	G-UP-A	Dip tank exhaust heat recovery with ECO #3 implemented	$225,142	1.3	20.0	NR
20	14	Energy efficient frequency converters	$147,457	0.6	25.1	NR
21	G-U-UP	Storm windows in Building 3	$29,144	1.0	26.2	NR
22	G-I-UP	Dip tank exhaust heat recovery in Building 350-South	$40,123	1.0	30.7	NR
23	J-UP	Medium paint booth exhaust heat recovery in Building 350	$382,804	1.1	31.0	NR
24	I-UP	Large paint booth exhaust heat recovery in Building 350	$382,805	1.1	32.8	NR
25	D-UP	Heat recovery from paint booths and engine test cells	$310,602	1.0	33.4	NR
26	G-P-UP	Strip curtains for warehouse doors in Buildings 2 and 4	$31,981	2.2	55.3	NR
27	R-UP	High pressure sodium lighting in warehouses	$287,199	0.3	59.7	NR
28	G-E-UP	Paint booth exhaust heat recovery in Building 1	$115,821	0.5	67.0	NR
29	G-F-UP	Paint booth exhaust heat recovery in Building 14	$93,779	0.4	85.2	NR
30	G-G-UP	Paint booth exhaust heat recovery in Building 37	$115,821	0.4	87.1	NR
31	G-J-UP	Main steam system expansion to Buiding 320	$1,065,732	0.0	147.4	NR
32	4	Heat recovery from paint booth exhaust air	-	-	-	-
33	7	No. 6 fuel oil recirculation control	-	-	-	-
34	2	"Steam" cleaning heat method modification	$15,985	-	-	-

NF - SIR > 1, but does not meet recommended funding requirements.
NR - Not recommended.

Table 5-3. Project Funding List

Funds	ECO ID	Project Description
QRIP	1	Compressed air valve replacement (Building 350)
	6	Heat recovery from condensate (Building 350)
	9	Paint booth fan controls (Buildings 37, 350 and 370)
	11	Blast booth fan cut off (Buildings 37 and 350)
	15	Modular offices (Buildings 6S, 8, 9)
OSD PIF	3	Dip tank covers (Buildings 1, 37, 350, 370)
	10	Paint booth air flow control (Buildings 320, 350)
ECIP (1)	16	Boiler conversion to natural gas (Building 349)
	5	EMCS in Building 370

(1) Submitted by LEAD as ECIPs.

5.2 Energy and Cost Savings

Energy and cost savings for the recommended project funding are listed in Table 5-4. Project capital costs are escalated at 4 percent per year according to the project implementation schedule as discussed below. Energy costs are in constant dollars using FY 92 prices. Projects #5, EMCS for Building 370 and #16, Boiler Conversion to Natural Gas have been programmed by LEAD into the ECIP program. The implementation of all projects yield a total annual energy savings of 53,400 MBtu and annual cost savings equal to $475,300. Low cost/no cost projects yield another 5,500 MBtu and $40,000 annual energy and cost savings, respectively. This totals to 58,900 MBtu and $515,300 annual savings, which represents reductions of 12 percent and 18 percent, respectively when compared to FY 90 values. Figures 5-1 and 5-2 show energy use and cost, respectively, at LEAD before and after implementation of these projects.

5.3 Project Schedule

Project implementation dates are estimated as follows:

QRIP, OSD PIF	FY 93
ECIP, MCA	FY 95

Following this schedule, Figures 5-3 and 5-4 were developed to show the impact implementation the recommended projects would have on energy use and cost, respectively, at LEAD.

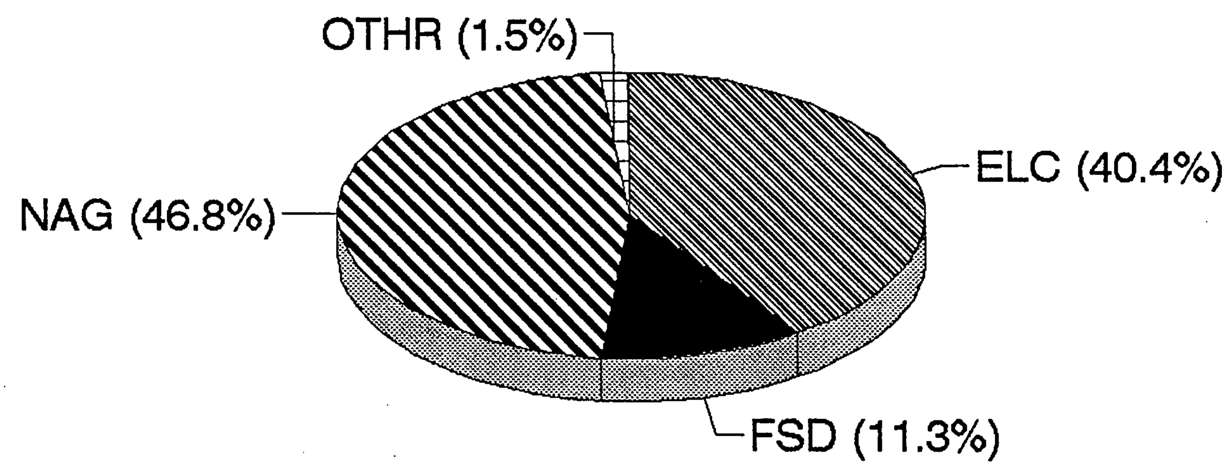
Table 5-4. Project Energy and Cost Savings

No.	Project #	ECO Names	Construction Cost Plus SIOH(1)	Annual Energy Savings MBtu	Annual Energy Savings $(2)	Project Funding	Project Year
1	9	Paint booth fan control	$5,254	5,019	$22,900	QRIP	93
2	11	Blast booth fan cut off	$7,450	1,610	$17,613	QRIP	93
3	6	Heat recovery from condensate	$2,766	938	$4,100	QRIP	93
4	3	Dip tank covers with exhaust fan controls	$214,857	28,530	$137,400	OSD PIF	93
5	15	Modular offices	$26,608	2,755	$13,600	QRIP	93
6	1	Compressed air valve replacement	$8,285	366	$4,004	QRIP	93
7	5	EMCS in Building 370	$194,184	9,176	$57,700	ECIP	95
8	10	Paint booth air flow control	$242,367	11,574	$64,100	OSD PIF	93
9	16	Boiler conversion to natural gas	$2,704,976	0	$160,200	ECIP	95
TOTALS			$3,406,747	53,400 (3)	$475,300 (3)		

(1) Escalated to year of implementation.
(2) Energy costs are in constant FY92 dollars.
(3) Total does not equal to column sum due to project synergism effects.

Letterkenny Army Depot

Energy Use After Project Implementation



Total Use = 413,400 MBtu

Does not include mobility fuels.

Figure 5-1

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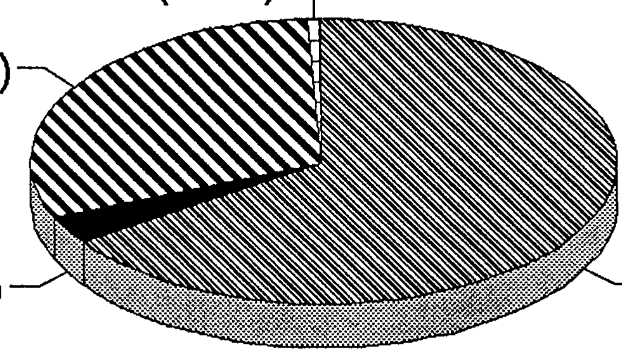
Energy Cost after Proj. Implementation



Total Use = $ 2,800,000

Does not include mobility fuels.

Figure 5-2

Letterkenny Army Depot
Effects of Project Implementation

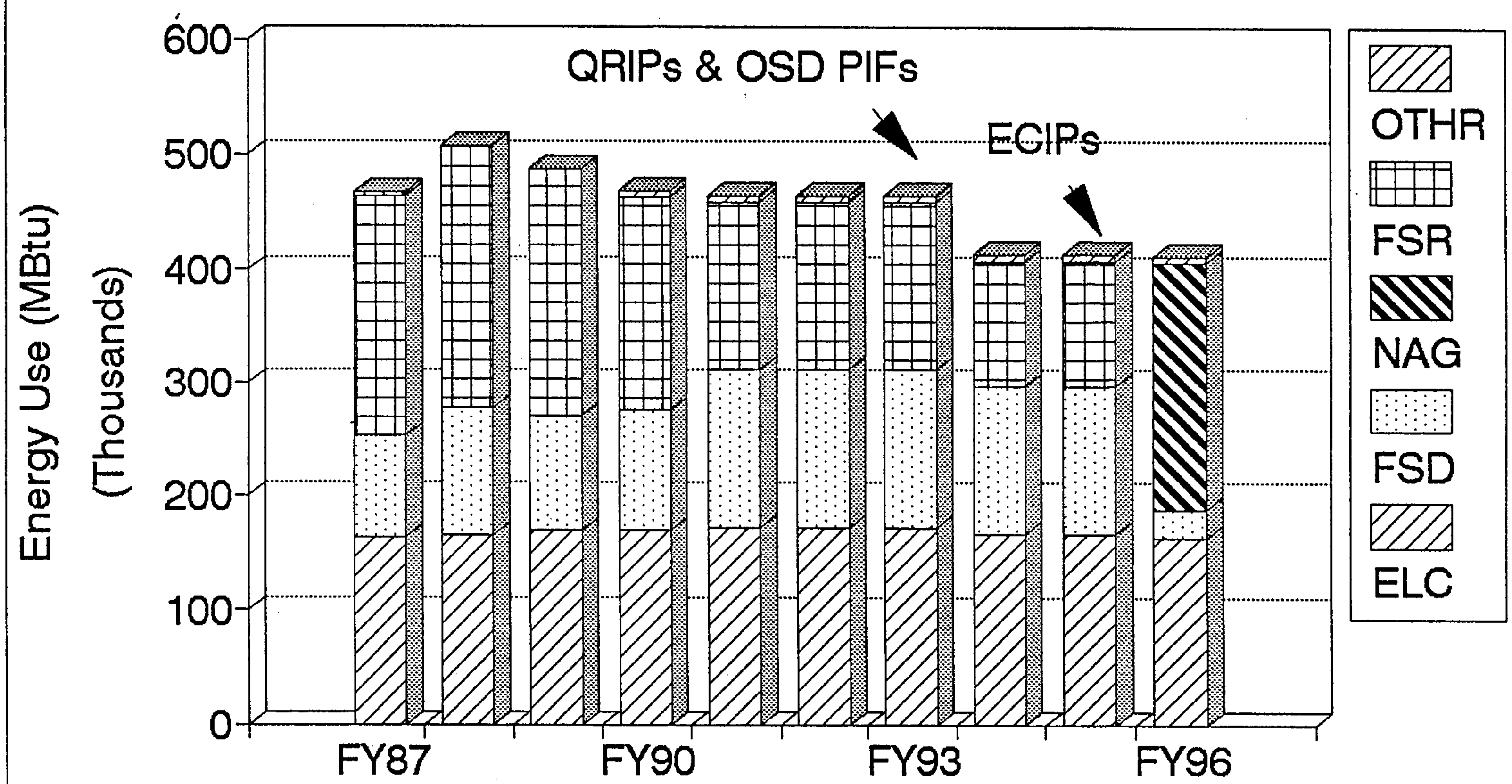


Figure 5-3

Letterkenny Army Depot
Effects of Project Implementation

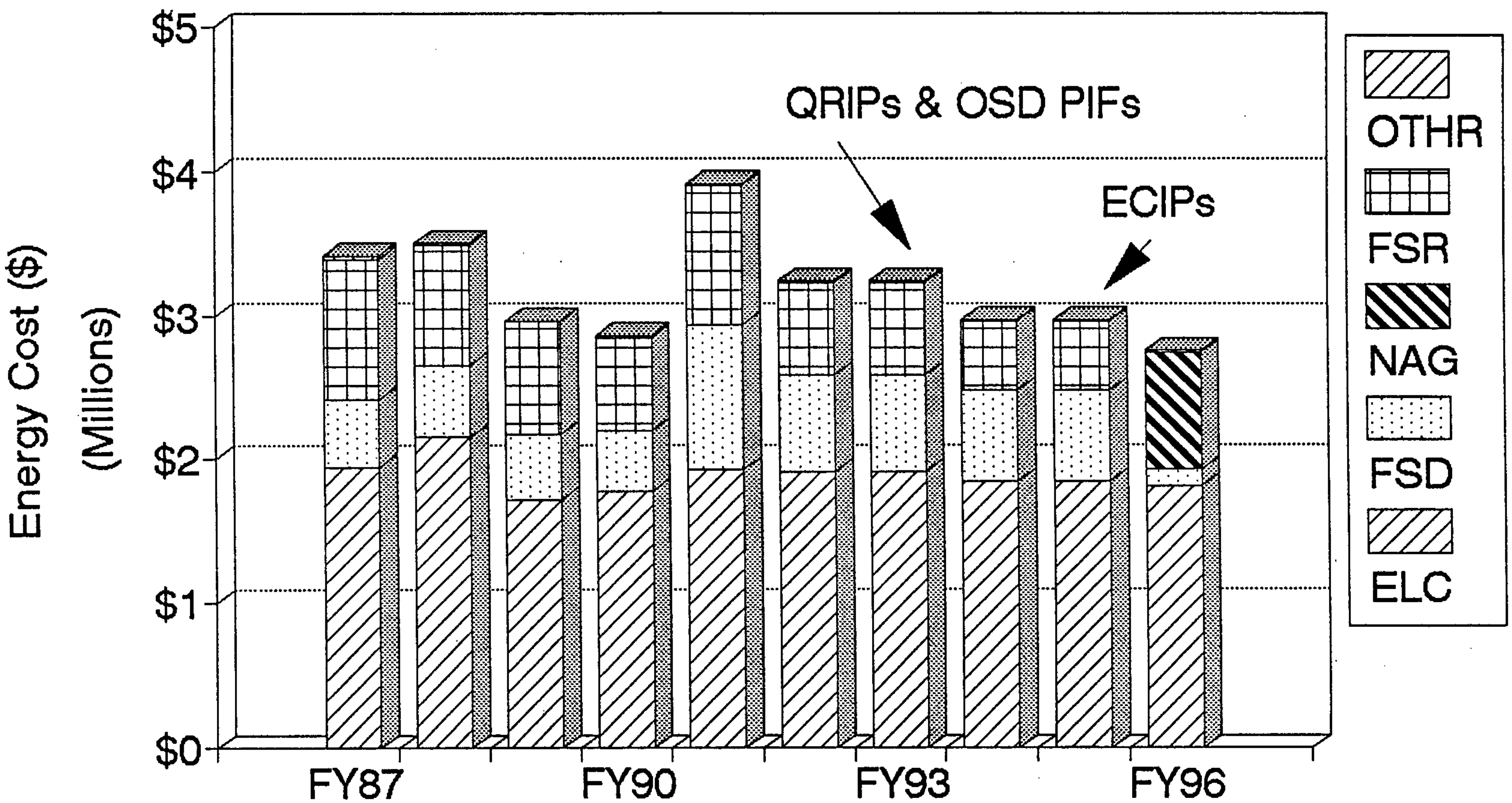


Figure 5-4

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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